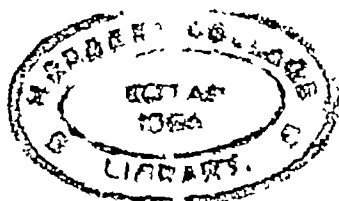


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WONDER BOOK
OF THE
WORLD'S PROGRESS

VOL. VIII
HISTORY • LITERATURE

FACSIMILE OF A PAGE OF GENESIS:
A SIXTH-CENTURY MANUSCRIPT

WONDER BOOK OF THE WORLD'S PROGRESS

By
HENRY SMITH WILLIAMS

IN TEN VOLUMES
Illustrated

•

VOLUME VIII
History
Literature



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INTRODUCTION

IN this volume we find ourselves far afield from the terrain of the preceding volume. There is the same geographical background, to be sure, and even the same national background. But the entire point of view has changed. We seem to breathe a different atmosphere. The world as we now envisage it is not a world of warring hosts, but a world of intellectual and artistic endeavor and achievement. We now have to do with "the glory that was Greece and the grandeur that was Rome" in a truer sense.

Our text will introduce a series of intellectual heroes, and serve in some measure to reveal the atmosphere of thought in the midst of which the great emotional creations of literature and art which made the "golden age of Greece" traditional were evolved. The pictures will serve to recall, in a measure, the material conditions of every-day life and the atmosphere of tradition—if you please, superstition—in which the most highly civilized nations of antiquity lived and moved and had their being.

Other elements of the textual and pictorial presentation will remind us that permanent history, as it comes to the attention of posterity, is not made by warriors and statesmen but by the tribe of chroniclers who set down in writing their own individual interpretations of the events they witnessed, or of which they learned by word of mouth from actual observers or through the medium of public gossip.

We shall gain glimpses of these chroniclers and their

works; and in particular we shall learn a good deal about the way in which the chronicles were originally inscribed — whether on sculptured walls, cylinders of baked clay, or rolls of papyrus or parchment—and of the vicissitudes through which they passed and the accidents of fortune that led to the destruction of the main records and the preservation of favored fragments.

This story of the mechanical side of the production and preservation of literature is much less generally known than the subject matter, which in the aggregate constitutes the melange of fact, fable, tradition, honest misinterpretation, and prejudiced malinterpretation which ultimately does service as history.

The records of this character here introduced were gathered many years ago, largely from the marvelous storehouse of the British Museum, and published for me under title of *The History of the Art of Writing* in four elephantine portfolios, with two hundred facsimiles, many of them in full color, by the Encyclopedia Britannica Company—constituting a production of truly regal proportions, the unique contents of which are now for the first time brought substantially, even if only selectively, within reach of the general public.

Tho of necessity greatly reduced in size to meet the conditions of the present format, the documents here (and in the next volume) reproduced in photogravure, retain in large measure their original appearance and will amply repay the scrutiny of persons as widely separated in viewpoint and interest as the critical historian, the philologist, the paleographer, the calligrapher, and the proverbial "average reader."

It goes without saying that a lover of literature must find this collection of documents, which few private collections can rival, of more than passing interest.

I

HISTORY AND HISTORIANS

BROADLY speaking, the historians of all recorded ages seem to have had the same general aims. They appear always to seek either to glorify something or somebody, or to entertain and instruct their readers. The observed variety in historical compositions arises not from difference in general motive, but from varying interpretations of the relative status of these objects, and from differing judgments as to the manner of thing likely to produce these ends, combined, of course, with varying skill in literary composition and varying degrees of freedom of action.

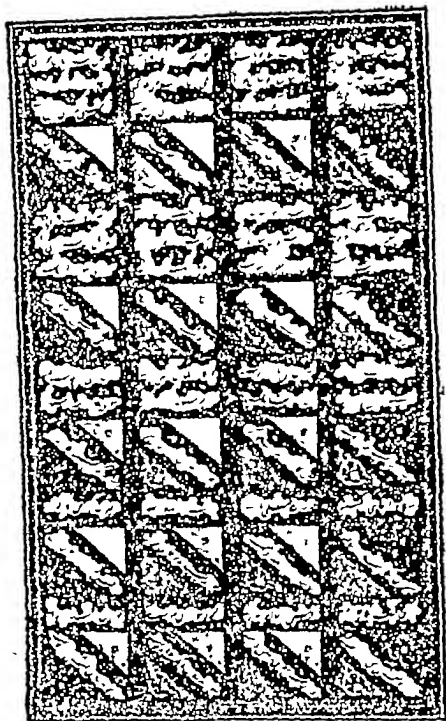
As to freedom of selective judgment, the earliest historians whose records are known to us exercised practically none at all. Their task was to glorify the particular monarch who commanded them to write. The records of a Ramses, a Sennacherib, or a Darius tell only of the successful campaigns, in which the opponent is so much as mentioned only in contrast with the prowess of the victor.

With these earliest historians, therefore, the ends of historical composition were met in the simplest way, by reciting the deeds, real or alleged, of a king, as Ramses, Sennacherib or David; or of the gods, as Osiris, or Ishtar, or Yahveh. As to entertainment and instruction, the reader was expected to be overawed by the recital of mighty deeds, and to draw the conclusion that it would be well for him to do homage to the glorified monarch, human or divine.

A little later, in what may be termed the classical period, the historians had attained to a somewhat freer position and wider vision, and they sought to glorify heroes who were neither gods nor kings, but the representatives of the people in a more popular sense. Thus the *Iliad* dwells upon the achievements of Achilles and Ajax and Hector rather than upon the deeds of Menelaus and Priam, the opposing kings. Hitherto the deeds of all these heroes would simply have been transferred to the credit of the king. Now the individual of lesser rank is to have a hearing. Moreover, the state itself is now considered apart from its particular ruler. The histories of Herodotus, of Xenophon, of Thucydides, of Polybius, in effect make for the glorification, not of individuals, but of peoples.

The shift from the purely egoistic to the altruistic standpoint marks a long step. The writer now has much more clearly in view the idea of entertaining, without frightening, his reader; and he thinks to instruct in matters pertaining to good citizenship and communal morality rather than in deference to kings and gods. In so doing the historian marks the progress of civilization of the Greek and early Roman periods.

In the medieval time there is a strong reaction. To frighten becomes again a method of attacking the consciousness; to glorify the gods and heroes a chief aim. As was the case in the Egyptian and Persian and Indian periods of degeneration, the early monotheism has given way to polytheism. Hagiology largely takes the place of secular history. A constantly growing company of saints demands attention and veneration. To glorify these, to show the futility of all human action that does not make for such glorification, became again an aim of the historian. But this influence is by no means altogether dom-



FACSIMILE OF A PAGE OF THE SHAH NAMAH,
BOOK OF KINGS THE GREAT EPIC OF PERSIA.

inant; and, tho there is no such list of historians worthy to be remembered as existed in the classical period, yet such names appear as those of Einhard, the biographer of Charlemagne; De Joinville, the panegyrist of Saint Louis; Villani, Froissart, and Monstrelet, the chroniclers; and Comines, Machiavelli, and Guicciardini.

In the modern period the gods have been more or less disbanded, the heroes modified, even the kings subordinated. We hear much talk of the "philosophy" of history, even of the "science" of history. Common sense and the critical spirit are supposed to hold sway everywhere. Yet, after all, it would be too much to suppose that any historian even of the most modern school has written entirely without prejudice of race, of station, or of religion. And in any event the same ideals, generally stated, are before the historian of today that have actuated his predecessors—to glorify something or somebody, tho it be perhaps a principle and not a person, and to entertain and instruct his readers.

The earliest historians whose writings have come down to us are the authors of the records on the monuments of Egypt and of Mesopotamia. These records, made in languages a knowledge of which has been recovered only in the past century, are full of historical interest because of the facts they narrate, and the insight they give us into the life of their times. For the moment, however, we are only concerned with the method of their construction. They are parts of records dating from many centuries before the beginning of the Christian era. Their authors are utterly unknown by name.

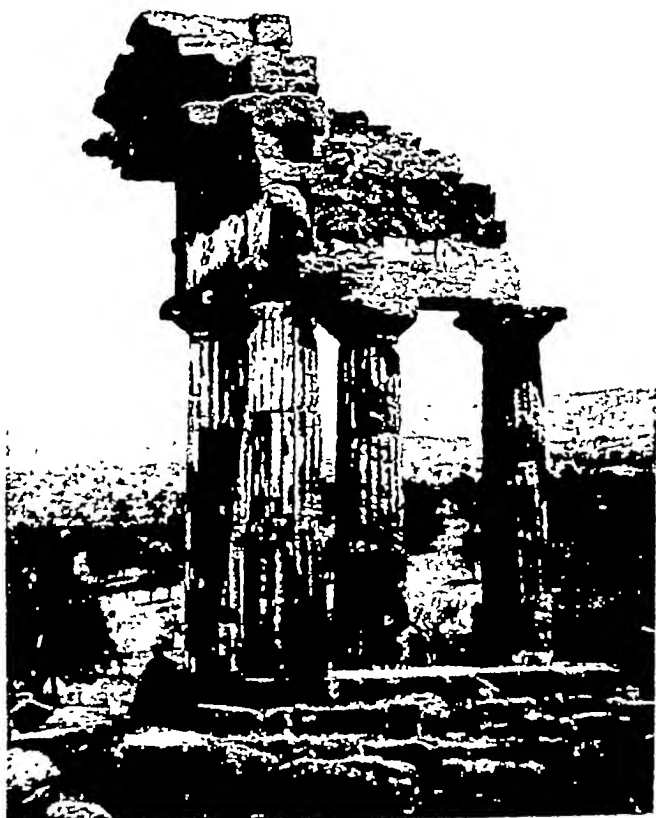
The narrative is, indeed, in some cases, couched in the first person, but it is not to be supposed from this that the alleged writer—who, of course, is the king whose deeds are glorified—is the actual composer of the

narrative. The actual scribes, mere adjuncts of the royal menage, never dreamed of putting their own names on record beside those of their royal masters. Yet their work has preserved to future generations the names of kings that otherwise would have been absolutely forgotten.

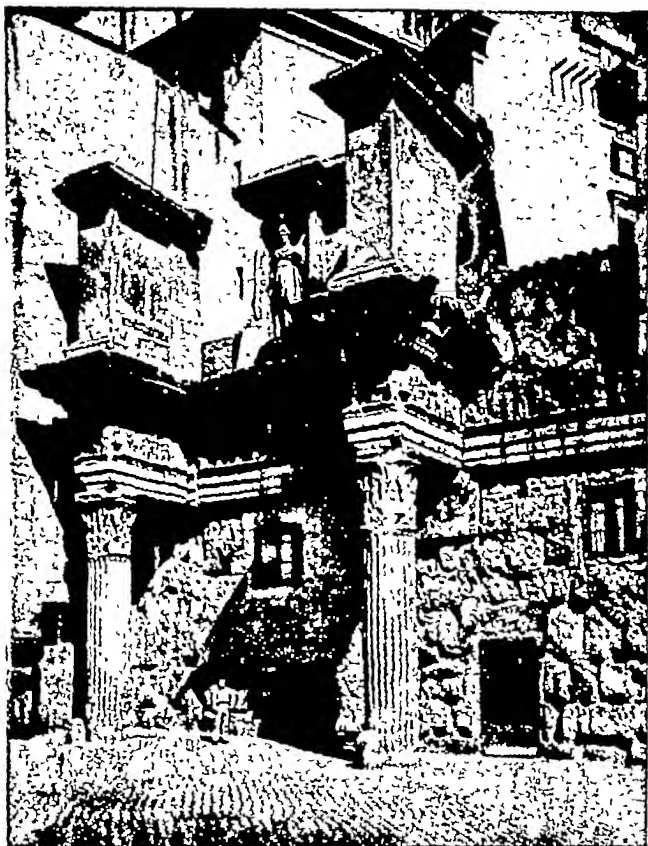
For example, Tehutimes III of Egypt and Asshur-banapal of Assyria, two of the most powerful monarchs of antiquity, had ceased to be remembered even by name several centuries before the dawn of our era, and for two thousand years no human being knew that such persons had ever existed. Yet now, thanks to the monuments, their deeds are almost as fully known to us as the deeds of an Alexander or a Cæsar.

There is, indeed, one regard in which these most ancient historical records have an advantage over more recent works. They were for the most part graven in stone or stamped in clay that was burned to stonelike hardness, and they have come down to us with the assurances of authenticity which must always be lacking in many compositions of more recent periods.

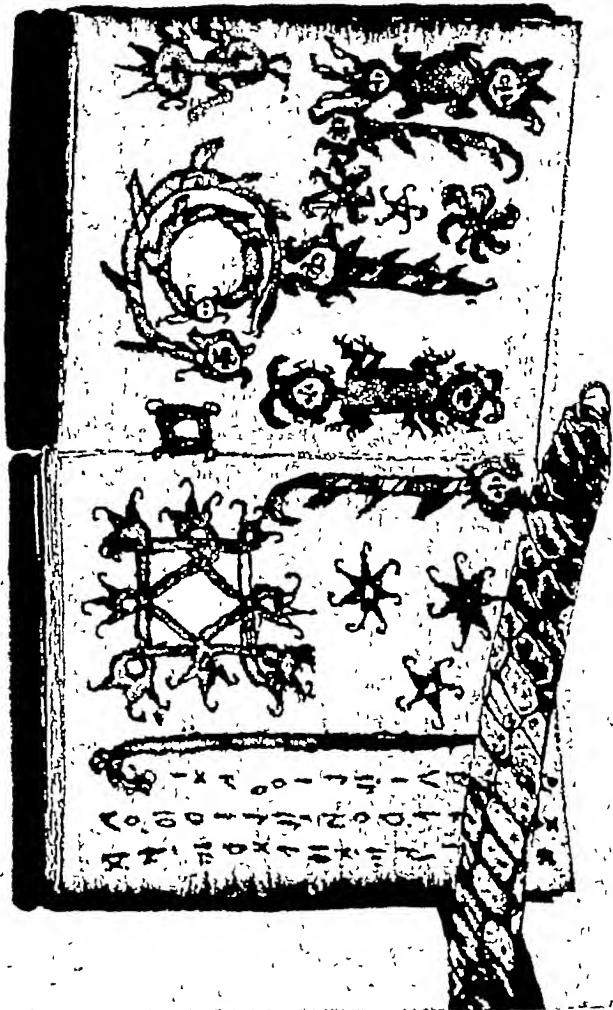
The Babylonian and Assyrian records lay buried with the ruins of cities whose very location had been forgotten for ages. The most recent of these records had been seen by no human eye for more than two thousand years. Their unnamed authors seem thus to speak to us directly across the centuries. However these earliest of historians may have dreamed of immortality for their work, they can hardly have hoped to speak to eager audiences in regions far beyond the limits of their world, twenty-five centuries after the very nation to which they belonged had vanished from the earth, and the language in which they wrote had ceased to be known to men. Yet that unique glory was reserved for them.



RUINS OF A GREEK TEMPLE



RUINS OF A ROMAN TEMPLE



FACSIMILE OF A PAGE OF BATTAK,
"SNAKE-SKIN" BOOK

It requires but a glance at the historians of the classical period to see how altered is the point of view from which they write. Here we have no longer men commanded by a monarch, or impelled by religious fervor to glorify a single person or epoch or country to the utter exclusion of everything else. We have bounded from insularity of view to universality. Even the Homeric legends deal with the events of two continents and of several countries. Herodotus and Diodorus make the writing of their histories a life-work. They travel from one country to another, and familiarize themselves with their subject as much as possible at first hand. They mingle with the scholars of many lands, and listen to their recitals of the annals of their respective peoples. They weigh and consider, tho in a quite different mental balance from that which a historian uses in our day. They spend thirty, forty years in composing their books.

From them, then, we have—not simple chronicles of a single event, but universal histories.

These are in many ways different from the universal histories of our own time; but in their frank, human way of looking out upon the world, they have a charm that is quite their own. In their interest for the general reader they have perhaps never been excelled. And in their citation of fact and fable they become a storehouse upon which succeeding generations of historians have drawn to this day.

There are other historians of the period no less remarkable, some of them even superior, from certain points of view, to these masters. The names of Thucydides, Xenophon, Polybius among the Greeks; of Tacitus, Livy, Cæsar among the Romans, to go no farther, are as familiar to every cultivated mind of our own day as the names of Gibbon, Macaulay or Bancroft.

Several of these were men who participated in the events they described, and, confining themselves to limited periods, treated these periods in such masterly fashion, with such breadth of view and discriminating judgment, that their verdicts have weight with all succeeding generations of historians. Thucydides, writing in the fifth century B.C., is regarded, even in our critical age, as a matchless writer of history. An oft-repeated tale relates that Macaulay despaired of ever equaling him, tho feeling that he might hope to duplicate the work of any other historian. Polybius and Tacitus are mentioned with respect by the most exacting investigators. Clearly, then, this was a culminating epoch in the writing of histories.

We have seen that in the classical period the brief space of half a dozen generations saw a cluster of great histories written. No such intellectual activity in this direction marked the medieval period. Now for the space of more than a thousand years there was no work produced that could bear a moment's comparison with the great productions of the earlier periods. One theme was now dominant in the Western world, and the intellects that might have produced histories of broad scope under other circumstances contented themselves with harping on the one string. So we have ecclesiastical records in place of histories.

In due time the reaction came, but it was long before the influence of the dominant spirit was made subordinate to a saner view. Indeed, scarcely before our own generation, since the classical period, have historians been able to cast a clear and unbiased glance across the entire field of history.

Toward the middle of the eighteenth century a school of secular historians with broad views and high aims

again arose. Now once more men sought to write world histories not dominated by a single idea. The first great exponents of the movement were Gibbon and Hume in England, Schlozzer and Müller in Germany. They have had a host of followers, of whom the greater number have been Germans.

The attitude of these modern writers is philosophical: they are disposed to recognize in the bald facts of human existence an importance commensurate solely with the lessons they can teach for the betterment of humanity.

In this modern view, each fact must be correlated with a multitude of other facts before its true significance can be perceived. Events are, in this view, meaningless unless we know something of the human motives that led to their enactment. The task of the historian is to search for causes, to endeavor to build up from the lessons of history a true philosophy of living. It is really a task no different from that which such ancient writers as Polybius had very prominently in view; but there is an emphasis upon this phase of the subject in our time that it did not generally receive in the earlier age.

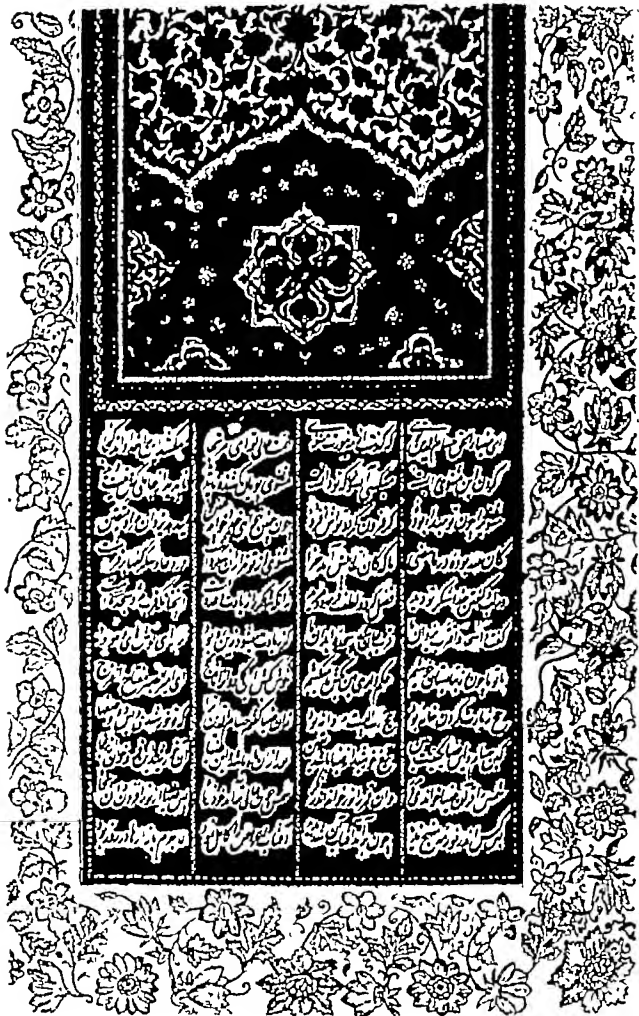
In other words, the philosophy of history of our time is a more conscious philosophy.

For a century past the phrase, "philosophy of history," has been current, and it has been the custom for men who were not primarily historians to discourse on the subject. Latterly, following again the current of the times, we have come to speak even of the "science" of history; indeed, in Germany in particular, history today claims unchallenged position as a true science. The word "science" is a very flexible term, yet there are those who deny that it may be properly applied, as yet at any rate, to our aggregation of knowledge of historical facts. The question resolves itself into a matter of definition.

The essential thing is that the modern historical investigator is fully actuated by the spirit of scientific accuracy and impartiality. And since impartiality depends very largely upon breadth of view, it results rather curiously that the minute investigations of the specialist make indirectly for the comprehensive view of the World Historian. Professor Freeman well expressed the idea when he said:

"My position is that in all our studies of history and language—and the study of language, besides all that it is in other ways, is one most important branch of the study of history—we must cast away all distinctions of 'ancient' and 'modern,' of 'dead' and 'living,' and must boldly grapple with the great fact of the unity of history. As man is the same in all ages, the history of man is one in all ages. No language, no period of history, can be understood in its fulness; none can be clothed with its highest interest and its highest profit, if it be looked at wholly in itself, without reference to its bearing on those other languages, those other periods of history, which join with it to make up the great whole of human, or at least of Aryan and European, being."

Such a position, assumed by one of the most minute searchers among modern histories, is highly interesting as illustrative of a reactionary tendency which will probably characterize the historical work of the near future. Hair-splitting analysis having been carried to its limits of refinement, there will probably come a reaction in the direction of a more comprehensive study of historical events in their wider relations. The work of the specialist, after all, is really important only when it furnishes material for wider generalizations. All minute workers in the fields of biology, geology, and the allied sciences, in the first half of the nineteenth century were uncon-



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BIOGRAPHY IN PERSIAN (18TH CENTURY A.D.)

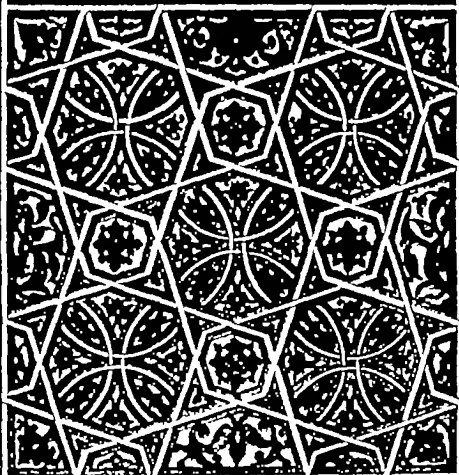
II

THE LITERATURE OF HISTORY

IT is obvious that the materials for the writing of history consist for the most part of written records. It is true that all manner of monuments, including the ruins of buried cities, remains of ancient walls and highways, and all other traces of a former civilization, must be allotted their share as records to guide the investigator in his attempt to reconstruct past conditions. But for anything like a definite presentation of the events of bygone days, it is absolutely essential, as Sir George Cornwall Lewis pointed out in great detail, to have access to contemporary written records, either at first hand, or through the medium of copyists in case the original records themselves have been destroyed. Lewis reached the conclusion, as the result of his exhaustive examination of the credibility of early Roman history, that a tradition of a past event is hardly transmitted orally from generation to generation with anything like accuracy of detail for more than a century.

Theoretically, then, no accurate history could ever be constructed of events covering a longer period than about four generations before the introduction of writing. In actual practise the scope of the strictly historic view of man's progress is confined to very much narrower limits than this, for the simple reason that the earliest written records that might otherwise serve to give us glimpses of remote history have very rarely been preserved. The destruction of ancient inscriptions with

سورة الفاتحة



الملاحق والرعي

لَا اَنَا سَاكِبٌ رَامُوْا تَرْيِبُ قَصَصِ الْأُمُورِ الَّتِي خَلَقَهَا

the lapse of centuries has led to a great deal of difference of opinion as to the time when the art of writing was introduced among various nations. With reference to the Greeks in particular, the dispute has been ardently waged, many scholars contending that the art of writing was little practised in Greece until the sixth century B.C.

Later discoveries, in particular a knowledge of the inscription on the statue of Ramses at Abu Simbel, have made it clear that the earlier estimates were much too conservative, and it now seems probable that the Greeks had been acquainted with the art of writing for several—or perhaps many—centuries before the one previously fixed upon.

It is not to be supposed, however, that the practise of the art of writing was universal in that early day. On the other hand, it was doubtless very exceptional indeed for the average individual to be able to write, and such difficulties as the lack of writing material stood in the way of composition until a relatively late period. But whether the art of writing was much or little practised in the early days does not greatly matter so far as the present-day historian is concerned, since practically all specimens of early writing in Greece disappeared in the course of succeeding ages. No fragment of any book proper, no scrap of parchment or papyrus, no single waxen tablet from classic Greece, has been preserved to us.

The Greek authors are known to us only through the efforts of successive generations of copyists; and, with the exception of a comparatively small number of Egyptian papyri, there is almost nothing in existence representing the literature of classical Greece that is older than the Middle Ages. There are, to be sure, con-

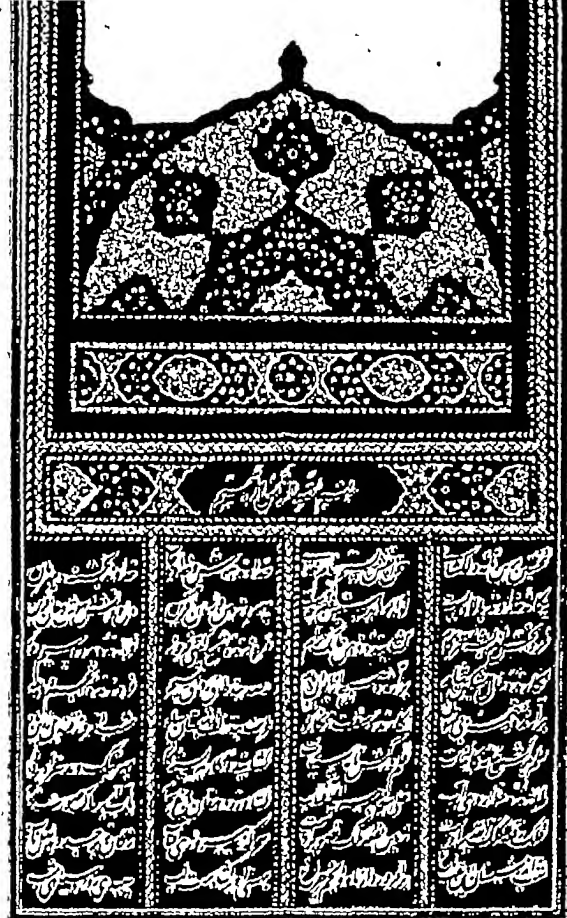
siderable numbers of monumental inscriptions dating from classical times. These have the highest interest for the archeologist, but in the aggregate they give only meager glimpses into the history of antiquity. If we were dependent upon these records for all that we know of Greek history, the entire story of that people might be told, as far as we could ever hope to learn it, in a few pages.

The case is somewhat different with Egypt and with Mesopotamia, since the climate of the former and the resistant character of the writing materials employed by the latter have permitted the modern world to receive direct messages that, under other circumstances, must inevitably have been lost.

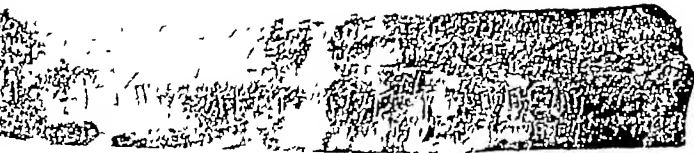
But even here the historical records are neither so abundant nor so comprehensive in their scope as might have been hoped. History-writing, in anything like a comprehensive meaning of the words, is a relatively modern art. The nearest approach to it among the nations of remote antiquity got no farther than the recording of the personal deeds of individual kings. Such records, indeed, are excellent materials for history, but they hardly constitute history by themselves.

The entire lists of Egyptian inscriptions, so far as known, suffice merely to give glimpses of Egyptian history; and if the Mesopotamian records are somewhat more satisfactory, it is only with reference to a comparatively brief period of later Assyrian history that they can be said to have anything like comprehensiveness.

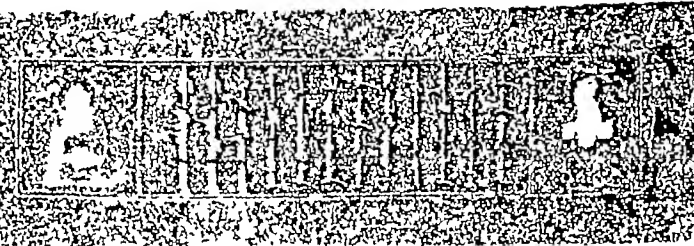
As to the other nations of Oriental antiquity—Indians, Persians, Syrians, the inhabitants of Asia Minor—the entire sum of the monumental records that have been transmitted to us amounts to nothing more than a scattered series of vague suggestions.



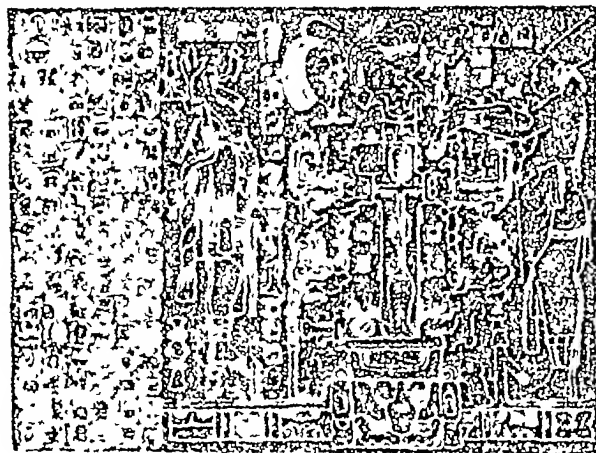
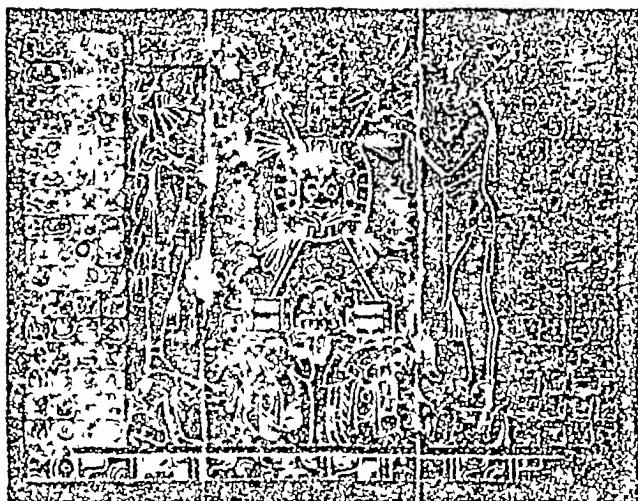
FACSIMILE OF MS. OF KHAWAR NAMA, A PERSIAN
POEM ON THE WARLIKE DEEDS OF ALI



A block of text in a script, likely Tibetan or Pali, consisting of several lines of characters. The text is arranged in a rectangular block and appears to be a transcription or a specific passage from a manuscript.



INSCRIPTION IN LATIN, GREEK AND PHENICIAN
 TIBETAN MANUSCRIPT — PALI MANUSCRIPT



In the classical world Rome is but little better off than Greece in this regard. As to both these countries, we depend for our knowledge almost exclusively upon the works of historians of a relatively late period. Before Herodotus, who lived in the fifth century B.C., there is almost no consecutive history proper of Greece; and despite all the efforts of archeologists, records of Roman progress scarcely suffice to push back the prehistoric veil beyond the time of the banishment of the kings. Indeed, even for a century or two after this event, the would-be historian finds himself still on very treacherous ground. The reason for this is that there were no contemporary historians in Rome in this early period; and until such contemporary chroniclers appear, no secure record of history is possible.

Once it became the fashion to write chronicles of events, the custom rapidly spread and took a fixed hold upon the people. From the day of Herodotus there was no dearth of Greek historians, and after Polybius there is an unbroken series of Roman chroniclers.

Had all the writings of these various workers been preserved, we should have abundant material for reconstructing the history of the entire later classical epoch in much detail; but, unfortunately, the historian worked with perishable materials. An individual papyrus or parchment roll could hardly be expected on the average to be preserved for more than a few generations, and unless copies had been made of it in the meantime, the record that it contained must inevitably be lost. Such has been the fate of the great mass of historical writings, no less than of productions in other fields of literature.

Many of the fragments of ancient writers have come down to us through rather curious channels. In the later age of Rome it became the fashion to make anthologies

and compilations, and it is through such collections that the majority of classical authors are known.

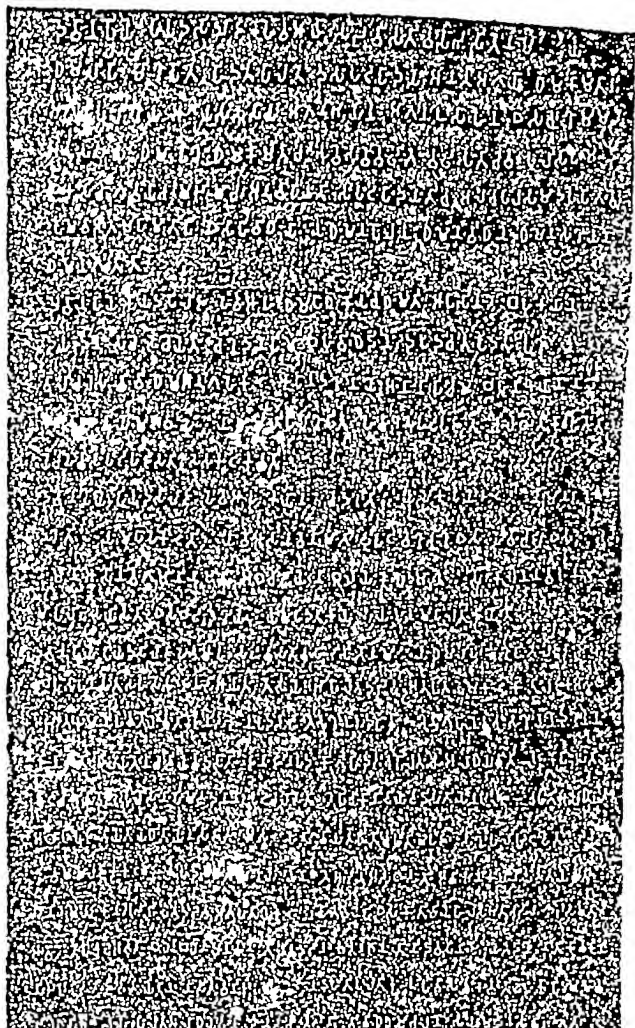
One of the most curious of these anthologies is that made by Athenæus about the beginning of the third century A.D. This author called his work *Deipnosophistoe*, or the Feast of the Learned. He attempted to give it a somewhat artistic form, making it ostensibly a dialog in which the sayings of a company of diners were related to a friend who was not present at the banquet. The diners were supposed to have introduced quotations from the classical writers, so that the book is chiefly made up of such quotations. The work has not come down to us quite in its entirety, but, even so, no fewer than eight hundred authors and twenty-five hundred different works are represented in the anthology.

Of these authors about seven hundred are known exclusively through the excerpts of Athenæus.

Two or three centuries later another Greek named Stobæus compiled a set of extracts from the Greek writers of all accessible periods prior to his own. The number of authors quoted in this anthology is more than five hundred, and here again the major part of them are quite unknown to us except through this single source.

Yet another collection of excerpts was made in the latter part of the ninth century by Photius, patriarch of Constantinople, who made excerpts from about 280 authors with whose works he had familiarized himself through miscellaneous reading.

In addition to these works of individual compilers there were two or three anthologies compiled in the Byzantine period, including an important collection of fragments of the Greek poets which is still extant under the title of *The Greek Anthology*, and the elaborate set of encyclopedias made under the direction of Constan-



EDICTS OF ASOKA, KING OF MAGADHA, INDIA
(THIRD CENTURY B C)

tine Porphyrogenitus. But for such collections as these, supplemented by the biographical notices of such workers as Suidas, and by fragments that have come to us through a few other channels, it would scarcely have been conceived that so many authors had written in the entire period of Grecian activity, since only a fraction of this number are represented by complete works that have come down to us.

Such facts as these give an inkling as to the mental activity of the old-time author, while pointing a useful lesson as to the perishability of human works. In this age of easy multiplying of books through printing, one is prone to forget how precarious must have been the existence of a manuscript of the elder day. It was a long, laborious task to produce an edition of a single copy of any extended work, and each successive duplication was precisely as slow and as difficult as the first.

Under these circumstances no doubt great numbers of books were never duplicated at all, and the circulation of a very large additional number most likely was limited to two or three copies.

It was only works which were early recognized as having an unusual intrinsic interest or value that stood any reasonable chance of being copied often enough to insure preservation through many succeeding generations.

As one considers the field of extant manuscripts, one is led naturally to reflect on the quality of work that was likely thus to insure perpetuity, and the more we consider the subject, the more clear it becomes that the one prime quality that gave a lease of life to the composition of an author was the quality of human interest. In other words, such compositions as were works of art, rather than such as depended upon other merits, were

the ones which successive generations of copyists reproduced, and which ultimately were enabled to pass the final ordeal imposed by the monks of the Middle Ages, who made palimpsests of many an author deserving a better fate.

The upshot of this process of the survival of the fittest was that all Greek would-be historians prior to Herodotus were allowed to sink into oblivion, causing Herodotus himself to stand out as apparently the absolute creator of a new art. Could we know the whole truth, it would doubtless appear that there was no real revolution of method effected by the writings of Herodotus. He surpassed all of his predecessors in such a measure that the future copyist saw no necessity for preserving any work but the one, since this one practically covered the field of all the rest.

It is, perhaps, an ill method of phrasing to say that these copyists saw no reason for preserving those earlier manuscripts. There was no thought in their minds of the preservation of one book and the destruction of another; they merely copied the work which interested them, or which they believed would interest others.

The disappearance of the works not copied was a mere negative result, about which no one directly concerned himself.

The proof of the value of the work of Herodotus is found in the fact that it has come down to us entire in numerous copies, something that can be said of only three or four other considerable historical compositions of the entire classical period; two others of this select company being Thucydides and Xenophon, both of whom were contemporaries of Herodotus, tho considerably younger, and therefore, properly enough, counted as belonging to the next generation.

Of the other Greek historians, the biographical works of Plutarch, the works of Strabo and Pausanias, which are geographical rather than strictly historical, and the *Life of Alexander the Great* by Arrian, are the sole ones of the large number undoubtedly written that have come down to us intact.

A survey of the Roman historians furnishes an even more striking illustration, for here no one of the great historical works has been preserved in its entirety. Livy's monumental work is entire as to the earlier books, which treat of the mythical and half-mythical period of Roman development; but the parts of it that treated of later Roman history, concerning which the author could have spoken, and probably did speak, with first-hand knowledge, are almost entirely lost.

In other words, the copyists of the Middle Ages preserved the least valuable portion of Livy, doubtless because they found the hero tales of mythical Rome more interesting than the matter-of-fact recitals of the events of the later republic and the early empire.

We can hardly suppose that Livy detailed the events of the later period with less art than characterized his earlier work, but different conditions were imposed upon him. He had now to deal with much fuller records than hitherto, and no doubt he treated many subjects that seemed important to him, simply because they were near at hand, but which another generation found tiresome and not worth the trouble of copying.

Thus we see emphasized again the salient point that the interesting story rather than the important historical narrative proved itself most fit for preservation in the estimate of posterity.

Of the other great historians of Rome, Tacitus, Dionysius, Dion Cassius, Polybius, have all fared rather

worse than Livy, altho a few briefer masterpieces, like the two histories of Sallust and the Gallic Wars of Cæsar, and such biographies as the *Lives* of Suetonius and Cornelius Nepos, were able to fight their way through the Middle Ages and gain the safe shelter of the printing-press without material loss

But perhaps the most suggestive example of all is furnished by the brief *World History* of Justin, which, if not quite entire, has been preserved as to its main structure in various manuscripts. This work is an artistic epitome of a large, and in its day authoritative, history of the world written by Trogus Pompeius.

Justin, when a student in Rome in the day of the early Cæsars, was led to make an epitome of this work, seemingly as proof to his friends in the provinces that he was not wasting his time. He did his task so well that future generations saw no reason to trouble themselves with the prolixities of the original work, but were content to copy and recopy the epitome, pointing the moral that brevity, next to artistic excellence, is the surest road to permanent remembrance for the historian—a lesson which many modern writers have overlooked to their disadvantage.

III

THE METHODS OF THE HISTORIANS

IT is a curious fact, a seeming paradox, that the first two great histories ever written—the histories, namely, of Herodotus and Thucydides—should stand out preeminently as types of two utterly different methods of historical writing. Herodotus, “the Father of History,” wrote with the obvious intention to entertain. There is no great logicality of sequence in his use of materials; he simply rambles on from one subject to another with little regard for chronology, but with the obvious intention everywhere to tell all the good stories that he has learned in the course of his journeyings. It would be going much too far to say that there is no method in his collocation of materials, but what method he has is quite generally overshadowed and obscured in the course of presentation.

Thus, for example, he is writing the history of the Persian wars, and he has reached that time in the history of Persia when Cambyses comes to the throne and prepares to invade Egypt. The mention of Egypt gives him the cue for an utterly new discourse, which he elaborates to the extent of an entire book, detailing all that he has learned of Egypt itself, its history, its people, and their manners and customs, without, for the most part, referring in any way whatever to Cambyses.

He returns to the Persian king ultimately, to be sure, and takes up his story regardless of the digression, and seemingly quite oblivious of any incongruity in the fact

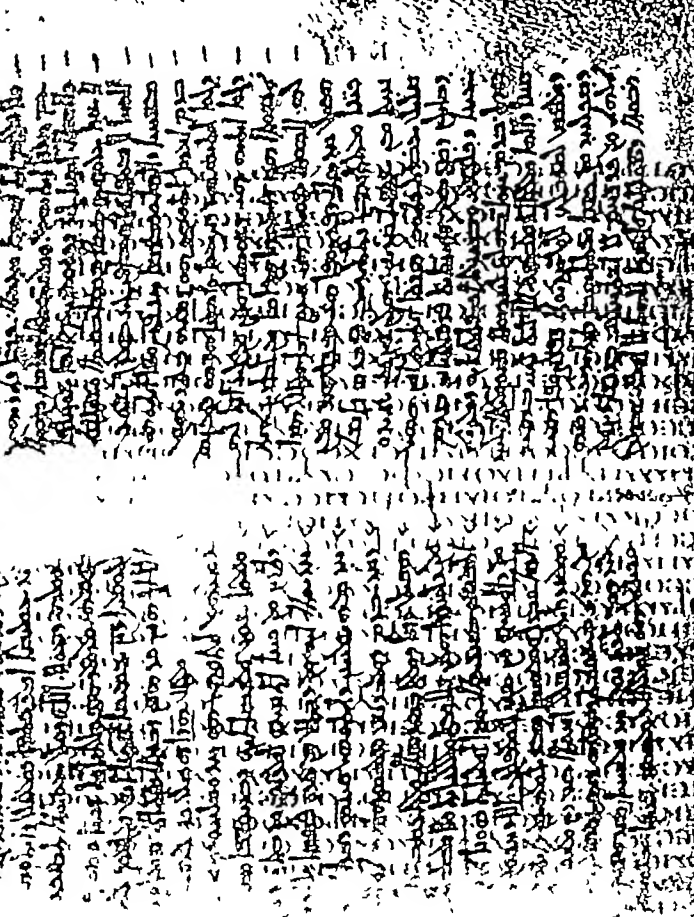
of having introduced very much more extraneous matter in reference to Egypt than the entire subject matter of the Persian Empire.

The method of Herodotus was justified by the results. There is every reason to believe that he was enormously popular in his own time—as popularity went in those days—and he has held that popularity throughout all succeeding generations. But it has been said of him often enough that his work is hardly a history in the narrower sense of the word; it is a pleasing collection of tales, in which no very close attempt is made to discriminate between fact and fiction, the prime motive being to entertain the reader.

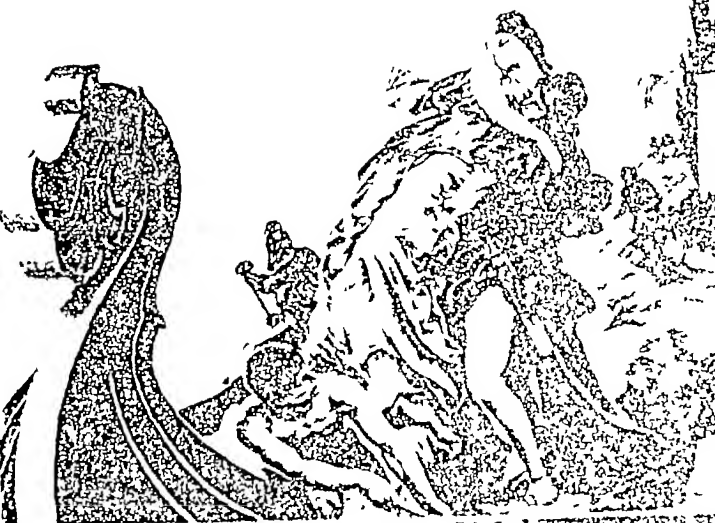
As such, the work of Herodotus stands at the head of a class which has been represented by here and there a striking example throughout all succeeding times.

Xenophon's *Anabasis*, detailing the story of Cyrus the Younger and his ten thousand Greek allies, is essentially a history of the same type. It differs radically, to be sure, from Herodotus, in that it holds with the closest consistency to a single narrative, scarcely giving the barest glimpses into any other field than that directly connected with the story of the ten thousand. But it is like Herodotus in the prime essential that its motive is to entertain the reader by the citation of the incidents of a venturesome enterprise.

Xenophon does indeed pause at the beginning of the second book long enough to pronounce a eulogy upon the character of Cyrus—a eulogy that is distinctly the biased estimate of a friend rather than the calm judgment of a critical historian. But this aside, Xenophon, philosopher tho he is, concerns himself not at all with the philosophy of the subject in hand. He quite ignores the immoral features of the rebellion of Cyrus against



HOMER'S ILIAD IN PALIMPSEST OVERWRITTEN
IN SYRIAN





HECTOR AND ANDROMACHE — ÆNEAS AND DIDO

his brother. Indeed, it seems never to occur to him that this fractricidal enterprise has any reprehensible features, or could be considered in any light other than that of a commendable proceeding, with a throne for the legitimate goal.

Doubtless the very fact of this banishment of the philosophical from the work of Xenophon has been one source of its great popularity, for, as every one knows, Xenophon shares with Herodotus the credit of being the most widely read of classical authors. It would be quite aside from the present purpose to emphasize the opinion that the intrinsic merit of Xenophon's work does not fully justify this popularity. It suffices here to note the fact that this famous work of the successor of Herodotus belongs essentially to the same class with the work of the master himself.

Of the Roman historians doubtless the one most similar to Herodotus in general aim was Livy. The author of the most famous history of Rome does not indeed make any such excursions into the history of outlying nations as did Herodotus, but he details the history of his own people with an eye always to the literary, rather than to the strictly historical, side; transmitting to us in their best form that series of beautiful legends with which all succeeding generations have been obliged to content themselves in lieu of history proper.

There is little of philosophical thought, little of search for motives, in such history-writing as this. It is essentially the art of the story-teller applied to the facts and fables of history.

Returning now to Thucydides, we have illustrated, as has been said, an utterly different plan and motive. Thucydides does indeed tell the story of the Peloponnesian War; tells it, moreover, with a wealth of detail

which no other historian of antiquity exceeded, and few approached. But in addition to narrating the plain facts, Thucydides searches always for the motives. He gives us an insight into the causes of events as he conceives them. He is obviously thinking more of this phase of the subject than of the mere recital of the facts themselves. It is the philosophy of history, rather than the story of history, that appeals to him, and that he wishes to make patent to the reader.

Only two of three other writers of the entire classical period whose works have been preserved followed Thucydides with any considerable measure of success in this attempt to write history philosophically; the two most prominent exponents of this method being the Greek Polybius, who told the story of Rome's rise to world power, and Tacitus, the famous author of the *Roman Annals* and of the earliest history of the German people.

These three examples — Thucydides, Polybius, and Tacitus — stand out at once in refutation of a claim which might otherwise be made that philosophical, or, if one prefers, didactic, historical composition is essentially a modern product. But for these exceptions one might be disposed to make a sweeping generalization to the effect that the old-time history was a collection of tales intended to entertain the reader, and that the strictly modern historical method aims at instruction rather than at entertainment.

Such generalizations, however, assuming, as they do, that the entire trend of human thought has fundamentally changed within historical times, are sure to be faulty. Quite possibly it may be true to say that the earliest historians tended as a class to write entertaining narratives rather than philosophical histories; and to say, on the other hand, that nineteenth-century histo-

rians as a class reversed the order of motives; but it must not be forgotten that our judgment here is based upon a mere fragment of the entire output of ancient historians.

We have already noticed that the names of some hundreds of Greek writers have been preserved to us solely through an anthological collection or two; and, speaking of the historical works, it must be remembered that a vast number of these have perished altogether. Whole companies of historians are known to us only by name, and there is every reason to suppose that considerable other companies that once existed and wrote works of greater or lesser importance have not left us even this memento. The scattered fragments of Greek historical works that have come to us, dissociated from any considerable part of their original context, fill three large volumes of the famous Didot collection of Greek classics, as edited by K. O. Müller; some hundreds of authors being represented.

We have noted that all the predecessors of Herodotus were blotted out, chiefly, perhaps, by the excellence of the work of Herodotus himself. Similarly the entire histories of Alexander the Great, written by his associates and contemporaries and his successors of the ensuing century, have without exception perished utterly.

Doubtless the excellence of the work of Arrian, which summarized and attempted to harmonize the contents of the more important preceding histories of Alexander, was responsible for the final elimination of the latter. One can hardly refer too often to that intellectual gantlet of the Middle Ages, which all classical literature was called upon to pass, and from which only here and there a work emerged. It is almost pathetic to consider the number of works that made their way heroically almost



ARMENIAN MANUSCRIPT THIRTEENTH
CENTURY

through this gantlet, only to succumb just before achieving the goal.

One knows, for example, that there was a work of Theopompus on later Grecian affairs, in fifty-odd books, which was extant in the ninth century, as proved by the summary of its contents made then by a monk, but of which no single line is in existence today.

Even the works that have survived in a less fragmentary condition have not usually been preserved entire in any single manuscript, but, as presented to us now, are patched together from various fragments found in widely separated collections.

The explanation is that the copying of a manuscript of great length was a somewhat heroic task, and that hence the copyist would often content himself with excerpting a single book from a work which he would have reproduced entire but for the labor involved.

The point of all this in our present connection is that we know the historians of antiquity very imperfectly, and that hence we are almost sure to misjudge them as a class when we attempt generalizations concerning them. In the very nature of the case, the historian who told a good story in a pleasing style stood a far better chance of being perpetuated, through the efforts of copyists, than did the philosophical historian, however profound, who put forward his theories at the expense of the narrative proper.

Making all due allowance for this, however, it can hardly be in doubt that the last century and a half has seen a remarkable development of the scientific spirit in its application to the work of the historian, and that the average historical work of the nineteenth and twentieth centuries is philosophically on a far higher plane than the average historical work of antiquity.



THE FLIGHT OF MEDEA

IV

THALES THE MILESIAN

HERODOTUS tells us that once upon a time—which time, as the modern computator shows us, was about the year 590 B.C.—a war had risen between the Lydians and the Medes and continued five years.

"In these years the Medes often discomfited the Lydians and the Lydians often discomfited the Medes (and among other things they fought a battle by night); and yet they still carried on the war with equally balanced fortitude. In the sixth year a battle took place in which it happened, when the fight had begun, that suddenly the day became night. And this change of the day Thales, the Milesian, had foretold to the Ionians, laying down as a limit this very year in which the change took place. The Lydians, however, and the Medes, when they saw that it had become night instead of day, ceased from their fighting and were much more eager, both of them, that peace should be made between them."

This memorable incident occurred while Alyattus, father of Cræsus, was king of the Lydians. The modern astronomer, reckoning backward, estimates this eclipse as occurring probably May 25, 585 B.C. The date is important as fixing a milestone in the chronology of ancient history, but it is doubly memorable because it is the first recorded instance of a predicted eclipse. Herodotus, who tells the story, was not born until about one hundred years after the incident occurred, but time had not dimmed the fame of the man who had performed the necromantic feat of prophecy.

Thales the Milesian, thanks in part at least to this accomplishment, had been known in life as first on the list of the Seven Wise Men of Greece, and had passed into history as the father of Greek philosophy. We may add that he had even found wider popular fame through being named by Hippolytus, and then by Father Æsop, as the philosopher who, intent on studying the heavens, fell into a well; "whereupon," says Hippolytus, "a maid-servant named Thratta laughed at him and said, 'In his search for things in the sky he does not see what is at his feet.'"

In the seventh century B.C., when Thales was born—and for a long time thereafter—the eastern shores of the Ægean Sea were quite as prominently the center of Greek influence as was the peninsula of Greece itself. Not merely Thales, but his followers and disciples, Anaximander and Anaximenes, were born there. So also was Herodotus, the Father of History, not to extend the list.

There is nothing anomalous, then, in the fact that Thales, the father of Greek thought, was born and passed his life on soil that was not geographically a part of Greece; but the fact has an important significance of another kind. Thanks to his environment, Thales was necessarily brought more or less in contact with Oriental ideas. There was close commercial contact between the land of his nativity and the great Babylonian capital off to the east, as also with Egypt. Doubtless this association was of influence in shaping the development of Thales's mind. Indeed, it was an accepted tradition throughout classical times that the Milesian philosopher had traveled in Egypt and had there gained at least the rudiments of his knowledge of geometry.

In the fullest sense, then, Thales may be regarded as representing a link in the chain of thought connecting

the learning of the old Orient with the nascent scholarship of the new Occident. Occupying this position, it is fitting that the personality of Thales should partake somewhat of mystery; that the scene may not be shifted too suddenly from the vague, impersonal East to the individualism of Europe.

All this, however, must not be taken as casting any doubt upon the existence of Thales as a real person. Even the dates of his life—640 to 546 B.C.—may be accepted as at least approximately trustworthy; and the specific discoveries ascribed to him illustrate equally well the stage of development of Greek thought, whether Thales himself or one of his immediate disciples were the discoverer.

We have already mentioned the feat which was said to have given Thales his great reputation. That Thales was universally credited with having predicted the famous eclipse is beyond question. That he actually did predict it in any precise sense of the word is open to doubt. At all events, his prediction was not based upon any such precise knowledge as that of the modern astronomer. There is, indeed, only one way in which he could have foretold the eclipse, and that is through knowledge of the regular succession of preceding eclipses. But that knowledge implies access on the part of some one to long series of records of practical observations of the heavens. Such records, as we have seen, existed in Egypt and even more notably in Babylonia. That these records were the source of the information which established the reputation of Thales is an unavoidable inference.

In other words, the magical prevision of the father of Greek thought was but a reflex of Oriental wisdom. Nevertheless, it sufficed to establish Thales as the father of Greek astronomy. In point of fact, his actual astro-

nomical attainments would appear to have been meager enough. There is nothing to show that he gained an inkling of the true character of the solar system. He did not even recognize the sphericity of the earth, but held, still following the Oriental authorities, that the world is a flat disk. Even his famous cosmogonic guess, according to which water is the essence of all things and the primordial element out of which the earth was developed, is but an elaboration of the Babylonian conception.

When we turn to the other field of thought with which the name of Thales is associated—namely, geometry—we again find evidence of the Oriental influence. The science of geometry, Herodotus assures us, was invented in Egypt. It was there an eminently practical science, being applied, as the name literally suggests, to the measurement of the earth's surface. Herodotus tells us that the Egyptians were obliged to cultivate the science because the periodical inundations washed away the boundary-lines between their farms. The primitive geometer, then, was a surveyor.

The Egyptian records, as now revealed to us, show that the science had not been carried far in the land of its birth. The Egyptian geometer was able to measure irregular pieces of land only approximately. He never fully grasped the idea of the perpendicular as the true index of measurement for the triangle, but based his calculations upon measurements of the actual side of that figure. Nevertheless, he had learned to square the circle with a close approximation to the truth, and, in general, his measurement sufficed for all his practical needs.

Just how much of the geometrical knowledge which added to the fame of Thales was borrowed directly from the Egyptians, and how much he actually created we cannot be sure. Nor is the question raised in disparage-

ment of his genius. Receptivity is the first prerequisite to progressive thinking, and that Thales reached out after and imbibed portions of Oriental wisdom argues in itself for the creative character of his genius.

Whether borrower or originator, however, Thales is credited with the expression of the following geometrical truths:

1. That the circle is bisected by its diameter
2. That the angles at the base of an isosceles triangle are equal.
3. That when two straight lines cut each other the vertical opposite angles are equal
4. That the angle in a semicircle is a right angle.
5. That one side and one acute angle of a right-angled triangle determine the other sides of the triangle.

It was by the application of the last of these principles that Thales is said to have performed the really notable feat of measuring the distance of a ship from the shore, his method being precisely the same in principle as that by which the guns are sighted on a modern man-of-war.

Another practical demonstration which Thales was credited with making, and to which also his geometrical studies led him, was the measurement of any tall object, such as a pyramid or building or tree, by means of its shadow. The method, tho simple enough, was ingenious. It consisted merely in observing the moment of the day when a perpendicular stick casts a shadow equal to its own length. Obviously the tree or monument would also cast a shadow equal to its own height at the same moment. It remains then but to measure the length of this shadow to determine the height of the object.

Such feats as this evidence the practicality of the genius of Thales. They suggest that Greek science, guid-



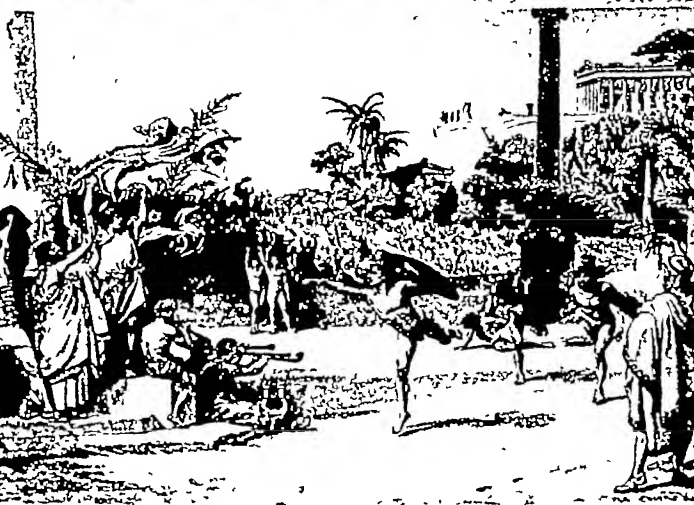
GREEK YOUTH — ACHILLES LAMENTS
OVER PATROCLUS

ed by imagination, was starting on the high-road of observation.

We are told that Thales conceived for the first time the geometry of lines, and that this, indeed, constituted his real advance upon the Egyptians. We are told also that he conceived the eclipse of the sun as a purely natural phenomenon, and that herein lay his advance upon the Chaldean point of view. But if this be true Thales was greatly in advance of his time, for it will be recalled that fully two hundred years later the Greeks under Nicias before Syracuse were so disconcerted by the appearance of an eclipse, which was interpreted as a direct omen and warning, that Nicias threw away the last opportunity to rescue his army.

Thucydides, it is true, in recording this fact speaks disparagingly of the superstitious bent of the mind of Nicias, but Thucydides also was a man far in advance of his time.

All that we know of the psychology of Thales is summed up in the famous maxim, "Know thyself," a maxim which, taken in connection with the proven receptivity of the philosopher's mind, suggests a marvelously rounded personality



OLYMPIC CONTESTS. WRESTLING, DISCUS
THROWING, RUNNING

PYTHAGORAS AND THE ROUND WORLD

DIOGENES LAERTIUS tells a story about a youth who, clad in a purple toga, entered the arena at the Olympian games and asked to compete with the other youths in boxing. He was derisively denied admission, presumably because he was beyond the legitimate age for juvenile contestants. Nothing daunted, the youth entered the lists of men, and turned the laugh on his critics by coming off victor.

The youth who performed this feat was named Pythagoras.

He was the same man, if we may credit the story, who afterwards migrated to Italy and became the founder of the famous Crotonian School of Philosophy; the man who developed the religion of the Orphic mysteries; who conceived the idea of the music of the spheres; who promulgated the doctrine of metempsychosis; who first, perhaps, of all men clearly conceived the notion that this world on which we live is a ball which moves in space and which may be habitable on every side.

A strange development that for a stripling pugilist. But we must not forget that in the Greek world athletics held a peculiar place. The chief winner of Olympian games gave his name to an epoch (the ensuing Olympiad of four years), and was honored almost before all others in the land.

A sound mind in a sound body was the motto of the day. To excel in feats of strength and dexterity was an

accomplishment that even a philosopher need not scorn.

It will be recalled that Æschylus distinguished himself at the battle of Marathon; that Thucydides, the greatest of Greek historians, was a general in the Peloponnesian War; that Xenophon, the pupil and biographer of Socrates, was chiefly famed for having led the Ten Thousand in the memorable campaign of Cyrus the Younger; that Plato himself was credited with having shown great aptitude in early life as a wrestler.

If, then, Pythagoras the philosopher was really the Pythagoras who won the boxing contest, we may suppose that in looking back upon this athletic feat from the heights of his priesthood—for he came to be almost deified—he regarded it not as an indiscretion of his youth, but as one of the greatest achievements of his life. Not unlikely he recalled with pride that he was credited with being no less an innovator in athletics than in philosophy. At all events, tradition credits him with the invention of "scientific" boxing.

Was it he, perhaps, who taught the Greeks to strike a rising and swinging blow from the hip, as depicted in the famous metopes of the Parthenon?

If so, the innovation of Pythagoras was as little heeded in this regard in a subsequent age as was his theory of the motion of the earth; for to strike a swinging blow from the hip, rather than from the shoulder, is a trick which the pugilist learned anew in our own day.

But our concern is with another "science" than that of the arena. We must follow the purple-robed victor to Italy—if, indeed, we be not over-credulous in accepting the tradition—and learn of triumphs of a different kind that have placed the name of Pythagoras high on the list of the fathers of Grecian thought.

To Italy? Yes, to the western limits of the Greek world. Here it was, beyond the confines of actual Greek territory, that Hellenic thought found its second home, its first home being, as we have seen, in Asia Minor. Pythagoras, indeed, to whom we have just been introduced, was born on the island of Samos, which lies near the coast of Asia Minor, but he probably migrated at an early day to Crotona, in Italy.

There he lived, taught, and developed his philosophy until rather late in life, when, having incurred the displeasure of his fellow citizens, he suffered the not unusual penalty of banishment.

Of the three other great Italic leaders of thought of the early period, Xenophanes came rather late in life to Elea and founded the famous Eleatic School, of which Parmenides became the most distinguished ornament. These two were Ionians, and they lived in the sixth century before our era. Empedocles, the Sicilian, was of Doric origin. He lived about the middle of the fifth century B.C., at a time, therefore, when Athens had attained a position of chief glory among the Greek states; but there is no evidence that Empedocles ever visited that city, tho it was rumored that he returned to the Peloponnesus to die.

The other great Italic philosophers just named, living, as we have seen, in the previous century, can scarcely have thought of Athens as a center of Greek thought. Indeed, the very fact that these men lived in Italy made that peninsula, rather than the mother-land of Greece, the center of Hellenic influence.

But all these men, it must constantly be borne in mind, were Greeks by birth and language, fully recognized as such in their own time and by posterity.

Yet the fact that they lived in a land which was at



no time a part of the geographical territory of Greece must not be forgotten. They, or their ancestors of recent generations, had been pioneers among those venturesome colonists who reached out into distant portions of the world, and made homes for themselves in much the same spirit in which colonists from Europe began to populate America some two thousand years later.

In general, colonists from the different parts of Greece localized themselves somewhat definitely in their new homes; yet there must naturally have been a good deal of commingling among the various families of pioneers, and, to a certain extent, a mingling also with the earlier inhabitants of the country. This racial mingling, combined with the well-known vitalizing influence of the pioneer life, led, we may suppose, to a more rapid and more varied development than occurred among the home-staying Greeks. In proof of this, witness the remarkable schools of philosophy which were thus developed at the confines of the Greek world, and which were presently to invade and, as it were, take by storm the mother country itself.

As to the personality of these pioneer philosophers of the West, our knowledge is for the most part more or less traditional. What has been said of Thales may be repeated, in the main, regarding Pythagoras, Parmenides, and Empedocles. That they were real persons is not at all in question, but much that is merely traditional has come to be associated with their names.

Pythagoras was the senior, and doubtless his ideas may have influenced the others more or less, tho each is usually spoken of as the founder of an independent school. Much confusion has all along existed, however, as to the precise ideas which were to be ascribed to each of the leaders. It is freely admitted that fable has woven

an impenetrable mesh of contradictions about their personalities, and it would be folly to hope that this same artificer had been less busy with their beliefs and theories.

When one reads that Pythagoras advocated an exclusively vegetable diet, yet that he was the first to train athletes on meat diet; that he sacrificed only inanimate things, yet that he offered up a hundred oxen in honor of his great discovery regarding the sides of a triangle, and such like inconsistencies in the same biography, one gains a realizing sense of the extent to which diverse traditions enter into the story as it has come down to us.

And yet we must reflect that most men change their opinions in the course of a long lifetime, and that the antagonistic reports may both be true.

True or false, these fables have an abiding interest, since they prove the unique and extraordinary character of the personality about which they are woven. "It is no ordinary man," said George Henry Lewes, speaking of Pythagoras, "whom fable exalts into the poetic region. Whenever you find romantic or miraculous deeds attributed, be certain that the hero was great enough to maintain the weight of the crown of this fabulous glory."

We may not doubt, then, that Pythagoras, Parmenides, and Empedocles, with whose names fable was so busy throughout antiquity, were men of extraordinary personality. We are here chiefly concerned, however, neither with the personality of the man nor yet with the precise doctrines which each one of them taught. At best we can merely outline, even here not too precisely, the doctrines which the Italic philosophers as a whole seem to have advocated.

First and foremost, there is the doctrine that the earth is a sphere. So far as we can ascertain, no Egyptian or





GREEK WOMEN AGE OF PERICLES





PINDAR AT OLYMPIA — ALCIBIADES,
AGATHON, AND SOCRATES

Babylonian astronomer had ever grasped that wonderful conception.

That the Italic Greeks should have conceived the idea was perhaps not so much because they were astronomers as because they were practical geographers and geometers.

Pythagoras, as we have noted, was born at Samos, and, therefore, made a relatively long sea voyage in passing to Italy. Now, as every one knows, the most simple and tangible demonstration of the convexity of the earth's surface is furnished by observation of an approaching ship at sea. On a clear day a keen eye may discern the mast and sails rising gradually above the horizon, to be followed in due course by the hull. Similarly, on approaching the shore, high objects become visible before those that lie nearer the water.

It is at least a plausible supposition that Pythagoras may have made such observations as these during the voyage in question, and that therein may lie the germ of that wonderful conception of the world as a sphere.

To what extent further proof, based on the fact that the earth's shadow when the moon is eclipsed is always convex, may have been known to Pythagoras we cannot say. There is no proof that any of the Italic philosophers made extensive records of astronomical observations as did the Egyptians and Babylonians; but we must constantly recall that the writings of classical antiquity have been almost altogether destroyed. The absence of astronomical records is, therefore, no proof that such records never existed.

Pythagoras is reported to have traveled in Egypt, and he must there have gained an inkling of astronomical methods. Indeed, he speaks of himself specifically, in a letter quoted by Diogenes, as one who is accustomed to

study astronomy. Yet a later sentence of the letter, which asserts that the philosopher is not always occupied about speculations of his own fancy, suggesting, as it does, the dreamer rather than the observer, gives us probably a truer glimpse into the philosopher's mind.

There is, indeed, reason to suppose that the doctrine of the sphericity of the earth appealed to Pythagoras chiefly because it accorded with his conception that the sphere is the most perfect solid, just as the circle is the most perfect plane surface.

Be that as it may, the fact remains that we have here, as far as we can trace its origin, the first expression of the scientific theory that the earth is round. Had the Italic philosophers accomplished nothing more than this, their accomplishment would none the less mark an epoch in the progress of thought.

That Pythagoras was an observer of the heavens is further evidenced by the statement made by Diogenes, on the authority of Parmenides, that Pythagoras was the first person who discovered or asserted the identity of Hesperus and Lucifer—that is to say, of the morning and the evening star. This was really a remarkable discovery. To have made it argues again for the practicality of the mind of Pythagoras.

His, indeed, would seem to have been a mind in which practical common-sense was strangely blended with the capacity for wide and imaginative generalization.

As further evidence of his practicality, it is asserted that he was the first person who introduced measures and weights among the Greeks, this assertion being made on the authority of Aristoxenus. It will be observed that he is said to have introduced, not to have invented, weights and measures, a statement which suggests a knowledge on the part of the Greeks that weights and

measures were previously employed in Egypt and Babylonia.

The mind that could conceive the world as a sphere and that interested itself in weights and measures was, obviously, a mind of the visualizing type. It is characteristic of this type of mind to be interested in the tangibilities of geometry. Hence it is not surprising to be told that Pythagoras "carried that science to perfection."

The most famous discovery of Pythagoras in this field was that the square of the hypotenuse of a right-angled triangle is equal to the squares of the other sides of the triangle. We have already noted the fable that his enthusiasm over this discovery led him to sacrifice a hecatomb. Doubtless the story is apocryphal, but doubtless, also, it expresses the truth as to his fervid joy.

No line alleged to have been written by Pythagoras has come down to us. We are told that he refrained from publishing his doctrines, except by word of mouth. "The Lucanians and the Peucetians, and the Messapians and the Romans," we are assured, "flocked around him, coming with eagerness to hear his discourses; no fewer than six hundred came to him every night; and if any one of them had ever been permitted to see the master, they wrote of it to their friends as if they had gained some great advantage."

Nevertheless, we are assured that until the time of Philolaus no doctrines of Pythagoras were ever published, to which statement it is added that "when the three celebrated books were published, Plato wrote to have them purchased for him for a hundred minas."

But if such books existed, they are lost to the modern world, and we are obliged to accept the assertions of relatively late writers as to the theories of the great Crotonian.

VI

TWO PIONEER THINKERS

THERE is a whimsical tale about Pythagoras, according to which the philosopher was wont to declare that in an earlier state he had visited Hades, and had there seen Homer and Hesiod tortured because of the absurd things they had said about the gods. Apocryphal or otherwise, the tale suggests that Pythagoras was an agnostic as regards the current Greek religion of his time. The same thing is perhaps true of most of the great thinkers of this earliest period. But one among them was remembered in later times as having had a peculiar aversion to the anthropomorphic conceptions of his fellows. This was Xenophanes, who was born at Colophon probably about the year 580 B.C., and who, after a life of wandering, settled finally in Italy and became the founder of the so-called Eleatic School.

A few fragments of the philosophical poem in which Xenophanes expressed his views have come down to us, and these fragments include a tolerably definite avowal of his faith. "God is one supreme among gods and men, and not like mortals in body or in mind," says Xenophanes. Again he asserts that "mortals suppose that the gods are born (as they themselves are), that they wear man's clothing and have human voice and body; but," he continues, "if cattle or lions had hands so as to paint with their hands and produce works of art as men do, they would paint their gods and give them bodies in form like their own — horses like horses, cattle like

cattle." Elsewhere he says, with great acumen: "There has not been a man, nor will there be, who knows distinctly what I say about the gods or in regard to all things. For even if one chance for the most part to say what is true, still he would not know; but every one thinks that he knows."

In the same spirit Xenophanes speaks of the battles of Titans, of giants, and of centaurs as "fictions of former ages." All this tells of the questioning spirit which distinguishes the scientific investigator. Precisely whither this spirit led him we do not know, but the writers of a later time have preserved a tradition regarding a belief of Xenophanes that perhaps entitles him to be considered the father of geology. Thus Hippolytus records that Xenophanes studied the fossils to be found in quarries, and drew from their observation remarkable conclusions. His words are as follows:

"Xenophanes believes that once the earth was mingled with the sea, but in the course of time it became freed from moisture; and his proofs are such as these: that shells are found in the midst of the land and among the mountains, that in the quarries of Syracuse the imprints of a fish and of seals had been found, and in Paros the imprint of an anchovy at some depth in the stone, and in Melite shallow impressions of all sorts of sea products. He says that these imprints were made when everything long ago was covered with mud, and then the imprint dried in the mud. Further, he says that all men will be destroyed when the earth sinks into the sea and becomes mud, and that the race will begin anew from the beginning; and this transformation takes place for all worlds."

Here, then, we see this earliest of paleontologists studying the fossil-bearing strata of the earth, and drawing from his observations a marvelously scientific induc-

tion. Almost two thousand years later another famous citizen of Italy, Leonardo da Vinci, was independently to think out similar conclusions from like observations. But not until the nineteenth century of our era, some twenty-four hundred years after the time of Xenophanes, was the old Greek's doctrine to be accepted by the scientific world. The ideas of Xenophanes were known to his contemporaries and, as we see, quoted for a few centuries by his successors, then they were ignored or quite forgotten; and if any philosopher of an ensuing age before the time of Leonardo championed a like rational explanation of the fossils, we have no record of the fact. The geological doctrine of Xenophanes, then, must be listed among those remarkable Greek anticipations of nineteenth-century science which suffered almost total eclipse in the intervening centuries.

The latest of the important pre-Socratic philosophers of the Italic school was Empedocles, who was born about 494 B. C. and lived to the age of sixty. These dates make Empedocles strictly contemporary with Anaxagoras, a fact which we shall do well to bear in mind when we come to consider the latter's philosophy in the succeeding chapter.

Like Pythagoras, Empedocles is an imposing figure. Indeed, there is much of similarity between the personalities, as between the doctrines, of the two men. Empedocles, like Pythagoras, was a physician; like him also he was the founder of a cult. As statesman, prophet, physicist, physician, reformer, and poet he showed a versatility that, coupled with profundity, marks the highest genius. In point of versatility we shall perhaps hardly find his equal at a later day—unless, indeed, an exception be made of Eratosthenes.

The myths that have grown about the name of Em-

pedocles show that he was a remarkable personality. He is said to have been an awe-inspiring figure, clothing himself in Oriental splendor and moving among mankind as a superior being. Tradition has it that he threw himself into the crater of a volcano that his otherwise unexplained disappearance might lead his disciples to believe that he had been miraculously translated; but tradition goes on to say that one of the brazen slippers of the philosopher was thrown up by the volcano, thus revealing his subterfuge. Another tradition of far more credible aspect asserts that Empedocles retreated from Italy, returning to the home of his fathers in Peloponnesus to die there obscurely.

It seems odd that the facts regarding the death of so great a man, at so comparatively late a period, should be obscure; but this, perhaps, is in keeping with the personality of the man himself. His disciples would hesitate to ascribe a merely natural death to so inspired a prophet.

Empedocles appears to have been at once an observer and a dreamer. He is credited with noting that the pressure of air will sustain the weight of water in an inverted tube; with divining, without the possibility of proof, that light has actual motion in space; and with asserting that centrifugal motion must keep the heavens from falling. He is credited with a great sanitary feat in the draining of a marsh, and his knowledge of medicine was held to be supernatural.

Fortunately, some fragments of the writings of Empedocles have come down to us, enabling us to judge at first hand as to part of his doctrines; while still more is known through the references made to him by Plato, Aristotle, and other commentators. Empedocles was a poet whose verses stood the test of criticism. In this regard he is in a like position with Parmenides, but in

neither case are the preserved fragments sufficient to enable us fully to estimate their author's scientific attainments. Philosophical writings are obscure enough at the best, and they perforce become doubly so when expressed in verse. Yet there are certain passages of Empedocles that are unequivocal and full of interest.

Perhaps the most important conception which the works of Empedocles reveal to us is the denial of anthropomorphism as applied to deity. We have seen how early the anthropomorphic conception was developed and how closely it was all along clung to; to shake the mind free from it then was a remarkable feat, in accomplishing which Empedocles took a long step in the direction of rationalism. His conception is paralleled by that of another physician, Alcmaeon, of Proton, who contended that man's ideas of the gods amounted to mere suppositions at the very most. A rationalistic or skeptical tendency has been the accompaniment of medical training in all ages.

The words in which Empedocles expresses his conception of deity have been preserved and are well worth quoting: "It is not possible," he says, "to draw near (to God) even with the eyes or to take hold of him with our hands, which in truth is the best highway of persuasion in the mind of man; for he has no human head fitted to a body, nor do two shoots branch out from the trunk, nor has he feet, nor swift legs, nor hairy parts, but he is sacred and ineffable mind alone, darting through the whole world with swift thoughts."

Considering for a moment the more tangible accomplishments of Empedocles, we find it alleged that one of his "miracles" consisted of the preservation of a dead body without putrefaction for some weeks after death. We may assume from this that he had gained in some

way a knowledge of embalming. As he was notoriously fond of experiment, and as the body in question (assuming for the moment the authenticity of the legend) must have been preserved without disfigurement, it is conceivable even that he had hit upon the idea of injecting the arteries.

This, of course, is pure conjecture; yet it finds a certain warrant, both in the fact that the words of Pythagoras lead us to believe that the arteries were known and studied, and in the fact that Empedocles' own words reveal him also as a student of the vascular system. Thus Plutarch cites Empedocles as believing "that the ruling part is not in the head or in the breast, but in the blood; wherefore in whatever part of the body the more of this is spread in that part men excel." And Empedocles' own words, as preserved by Stobæus, assert "(the heart) lies in seas of blood which dart in opposite directions, and there most of all intelligence centers for men; for blood about the heart is intelligence in the case of man." All this implies a really remarkable appreciation of the dependence of vital activities upon the blood.

This correct physiological conception, however, was by no means the most remarkable of the ideas to which Empedocles was led by his anatomical studies. His greatest accomplishment was to have conceived and clearly expressed an idea which the modern evolutionist connotes when he speaks of homologous parts—an idea which found a famous modern expositor in Goethe. Empedocles expresses the idea in these words:

"Hair, and leaves, and thick feathers of birds, are the same thing in origin, and reptile scales too on strong limbs. But on hedgehogs sharp-pointed hair bristles on their backs."

That the idea of transmutation of parts, as well as of

mere homology, was in mind is evidenced by a very remarkable sentence in which Aristotle asserts, "Empedocles says that finger-nails rise from sinew from hardening." Nor is this quite all, for surely we find the germ of the Lamarckian conception of evolution through the transmission of acquired characters in the assertion that "many characteristics appear in animals because it happened to be thus in their birth, as that they have such a spine because they happen to be descended from one that bent itself backward." Aristotle, in quoting this remark, asserts, with the dogmatism which characterizes the philosophical commentators of every age, that "Empedocles is wrong," in making this assertion; but Lamarck, who lived twenty-three hundred years after Empedocles, is famous in the history of the doctrine of evolution for elaborating this very idea.

It is fair to add, however, that the dreamings of Empedocles regarding the origin of living organisms led him to some conceptions that were much less luminous. On occasion, Empedocles the poet got the better of Empedocles the scientist, and we are presented with a conception of creation as grotesque as that which delighted the readers of *Paradise Lost* at a later day. Empedocles assures us that "many heads grew up without necks, and arms were wandering about, necks bereft of shoulders, and eyes roamed about alone with no foreheads." This chaotic condition, so the poet dreamed, led to the union of many incongruous parts, producing "creatures with double faces, offspring of oxen with human faces, and children of men with oxen heads." But out of this chaos came, finally, we are led to infer, a harmonious aggregation of parts, producing ultimately the perfected organisms that we see.

This is poetry rather than science, yet such imagin-

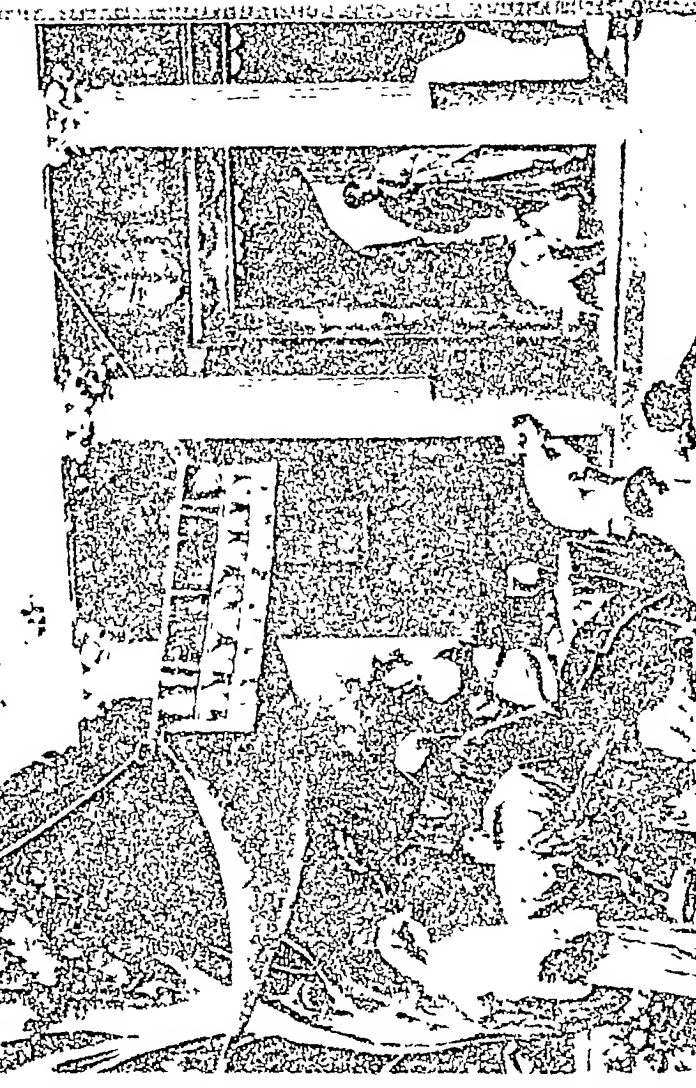
ings could come only to one who was groping toward what we moderns should term an evolutionary conception of the origins of organic life; and however grotesque some of these expressions may appear, it must be admitted that the morphological ideas of Empedocles, as above quoted, give the Sicilian philosopher a secure place among the anticipators of the modern evolutionist.



STATUE OF WRESTLERS



GOLDEN AGE OF GREECE





VII

ANAXAGORAS THE GREAT

WE have traveled rather far in our study of Greek thought and yet we have not until now come to Greece itself. And even now, the men whose names we are to consider were, for the most part, born in outlying portions of the empire; they differed from the others we have considered only in the fact that they were drawn presently to the capital.

The change is due to a most interesting sequence of historical events. In the day when Thales and his immediate successors taught in Miletus, when the great men of the Italic school were in their prime, there was no single undisputed center of Greek influence. The Greeks were a disorganized company of petty nations, welded together chiefly by unity of speech; but now, early in the fifth century B.C., occurred that famous attack upon the Western world by the Persians under Darius and his son and successor Xerxes. A few months of battling determined the fate of the Western world. The Orientals were hurled back; the glorious memories of Marathon, Salamis, and Plataea stimulated the patriotism and enthusiasm of all children of the Greek race. The Greeks, for the first time, occupied the center of the historical stage; for the brief interval of about half a century the different Grecian principalities lived together in relative harmony.

One city was recognized as the metropolis of the loosely bound empire; one city became the home of cul-

ture and the Mecca toward which all eyes turned; that city, of course, was Athens. For a brief time all roads led to Athens, as, at a later date, they all led to Rome.

The waterways which alone bound the widely scattered parts of Hellas into a united whole led out from Athens and back to Athens, as the spokes of a wheel to its hub. Athens was the commercial center, and, largely for that reason, it became the center of culture and intellectual influence also. The wise men from the colonies visited the metropolis, and the wise Athenians went out to the colonies. Whoever aspired to become a leader in politics, in art, in literature, or in philosophy, made his way to the capital, and so, with almost bewildering suddenness, there blossomed the civilization of the age of Pericles; the civilization which produced Æschylus, Sophocles, Euripides, Herodotus, and Thucydides; the civilization which made possible the building of the Parthenon.

Sometime during the early part of this golden age there came to Athens a middle-aged man from Clazomenæ, who, from our present standpoint, was a more interesting personality than perhaps any other in the great galaxy of remarkable men assembled there. The name of this newcomer was Anaxagoras. It was said in aftertime—we know not with what degree of truth—that he had been a pupil of Anaximenes. If so, he was a pupil who departed far from the teachings of his master. What we know for certain is that Anaxagoras was a truly original thinker, and that he became a close friend—in a sense the teacher—of Pericles and of Euripides.

Just how long he remained at Athens is not certain; but the time came when he had made himself in some way objectionable to the Athenian populace through

his teachings Filled with the spirit of the investigator, he could not accept the current conceptions as to the gods. He was a skeptic, an innovator. Such men are never welcome, they are the chief factors in the progress of thought, but they must look always to posterity for recognition of their worth; from their contemporaries they receive, not thanks, but persecution. Sometimes this persecution takes one form, sometimes another, to the credit of the Greeks be it said, that with them it usually led to nothing more severe than banishment. In the case of Anaxagoras, it is alleged that the sentence pronounced was death, but that, thanks to the influence of Pericles, this sentence was commuted to banishment. In any event, the aged philosopher was sent away from the city of his adoption. He retired to Lampsacus.

"It is not I that have lost the Athenians," he said, "it is the Athenians that have lost me."

The exact position which Anaxagoras had among his contemporaries, and his exact place in the development of philosophy, have always been somewhat in dispute. It is not known, of a certainty, that he even held an open school at Athens. Ritter thinks it doubtful that he did. It was his fate to be misunderstood, or underestimated, by Aristotle; that in itself would have sufficed greatly to dim his fame—might, indeed, have led to his almost entire neglect had he not been a truly remarkable thinker.

We are told that he wrote only a single book. It was said even (by Diogenes) that he was the first man that ever wrote a work in prose. The latter statement would not bear too close an examination, yet it is true that no extensive prose compositions of an earlier day than this have been preserved, tho numerous others are



STATUES OF PAN AND APOLLO

known by their fragments Herodotus, "the father of prose," was a slightly younger contemporary of the Clazomenæan philosopher; not unlikely the two men may have met at Athens.

Notwithstanding the loss of the greater part of the writings of Anaxagoras, however, a tolerably precise account of his scientific doctrines is accessible. Diogenes Laertius expresses some of them in very clear and precise terms. Following Diogenes, we find some remarkable scientific opinions ascribed to Anaxagoras

"He asserted," we are told, "that the sun was a mass of burning iron, greater than Peloponnesus, and that the moon contained houses and also hills and ravines." In corroboration of this, Plato represents him as having conjectured the right explanation of the moon's light, and of the solar and lunar eclipses. He had other astronomical theories that were more fanciful; thus "he said that the stars originally moved about in irregular confusion, so that at first the pole-star, which is continually visible, always appeared in the zenith, but that afterwards it acquired a certain declination, and that the Milky Way was a reflection of the light of the sun when the stars did not appear. The comets he considered to be a concourse of planets emitting rays, and the shooting-stars he thought were sparks, as it were, leaping from the firmament."

Much of this is far enough from the truth, as we now know it, yet all of it shows an earnest endeavor to explain the observed phenomena of the heavens on rational principles. To have predicated the sun as a great molten mass of iron was indeed a wonderful anticipation of the results of the modern spectroscope. Nor can it be said that this hypothesis of Anaxagoras was a purely visionary guess. It was in all probability a scientific de-

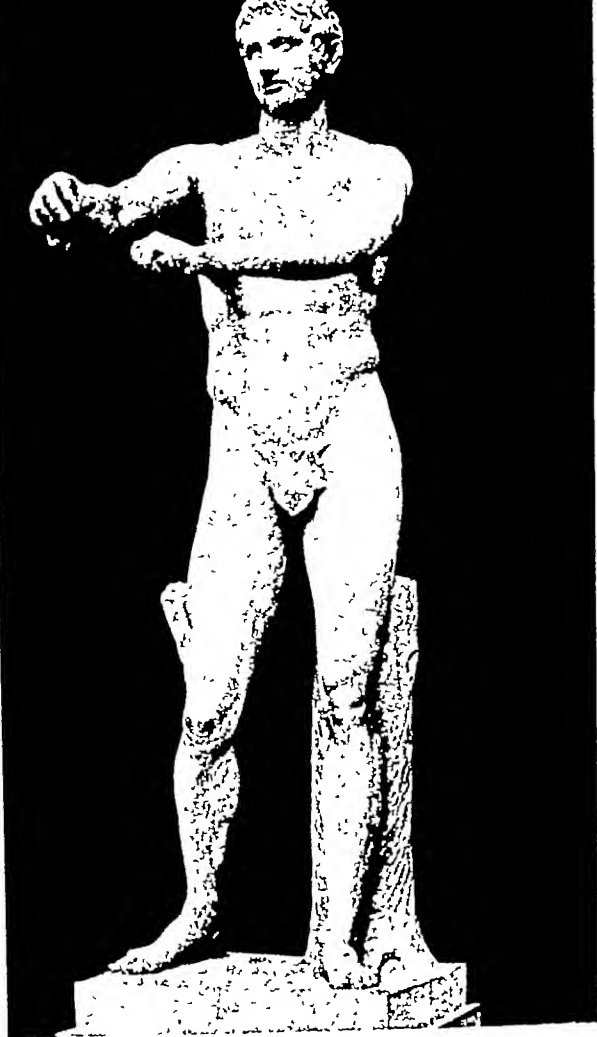
duction from the observed character of meteoric stones. The fact that something which falls from heaven as a blazing light turns out to be an iron-like mass may very well have suggested to the most rational of thinkers that the great blazing light called the sun has the same composition. This idea grasped, it was a not unnatural extension to conceive the other heavenly bodies as having the same composition

This led to a truly startling thought. Since the heavenly bodies are of the same composition as the earth, and since they are observed to be whirling about the earth in space, may we not suppose that they were once a part of the earth itself, and that they have been thrown off by the force of a whirling motion?

Such was the conclusion which Anaxagoras reached, such his explanation of the origin of the heavenly bodies. It was a marvelous guess. Deduct from it all that recent science has shown to be untrue; bear in mind that the stars are suns, compared with which the earth is a mere speck of dust, recall that the sun is parent, not daughter, of the earth, and despite all these deductions, the cosmogonic guess of Anaxagoras remains, as it seems to me, one of the most marvelous feats of human intelligence. It was the first explanation of the cosmic bodies that could be called, in any sense, an anticipation of what the science of our own day accepts as a true explanation of cosmic origins.

There is one other astronomical speculation for which the Clazomenæan philosopher has received full credit. It is generally admitted that it was he who first found out the explanation of the phases of the moon, a knowledge that that body shines only by reflected light, and that its visible forms, waxing and waning month by month from crescent to disk and from disk to crescent,





APOXYOMENOS: ANTIQUE COPY OF A
BRONZE BY LYSIPPUS



more remarkable insight than this would imply was shown by Anaxagoras when he asserted that a certain amount of air is contained in water, and that fishes breathe this air. The passage of Aristotle in which this opinion is ascribed to Anaxagoras is of sufficient interest to be quoted at length:

"Democritus of Abdera," says Aristotle, "and some others that have spoken concerning respiration, have determined nothing concerning other animals, but seem to have supposed that all animals respire. But Anaxagoras and Diogenes (Apolloniates), who say that all animals respire, have also endeavored to explain how fishes, and all those animals that have a hard, rough shell, such as oysters, mussels, etc., respire. And Anaxagoras, indeed, says that fishes, when they emit water through their gills, attract air from the mouth to the vacuum in the viscera from the water which surrounds the mouth; as if air was inherent in the water "

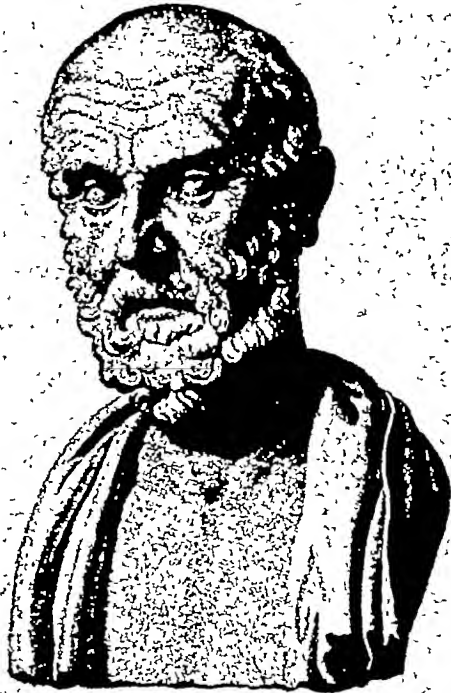
It should be recalled that of the three philosophers thus mentioned as contending that all animals respire, Anaxagoras was the elder; he, therefore, was presumably the originator of the idea. It will be observed, too, that Anaxagoras alone is held responsible for the idea that fishes respire air through their gills, "attracting" it from the water. This certainly was one of the shrewdest physiological guesses of any age, if it be regarded as a mere guess. With greater justice we might refer to it as a profound deduction from the principle of the uniformity of nature.

In making such a deduction, Anaxagoras was far in advance of his time as illustrated by the fact that Aristotle makes the citation just quoted merely to add that "such things are impossible," and to refute these "impossible" ideas by means of metaphysical reasonings

that seemed demonstrative not merely to himself, but to many generations of his followers

We are told that Anaxagoras alleged that all animals were originally generated out of moisture, heat, and earth particles. Just what opinion he held concerning man's development we are not informed. Yet there is one of his phrases which suggests—without, perhaps, quite proving—that he was an evolutionist. This phrase asserts, with insight that is fairly startling, that man is the most intelligent of animals because he has hands. The man who could make that assertion must, it would seem, have had in mind the idea of the development of intelligence through the use of hands—an idea the full force of which was not evident to subsequent generations of thinkers until the time of Darwin.

All in all, then, the work of Anaxagoras must stand as that of perhaps the most far-seeing scientific imagination of pre-Socratic antiquity.



HIPPOCRATES, THE FATHER OF MEDICINE

VIII

GREEK MEDICINE

MEDICINE among the early Greeks, before the time of Hippocrates, was a crude mixture of religion, necromancy, and mysticism. Temples were erected to the god of medicine, Æsculapius, and sick persons made their way, or were carried, to these temples, where they sought to gain the favor of the god by suitable offerings, and learn the way to regain their health through remedies or methods revealed to them in dreams by the god. When the patient had been thus cured, he placed a tablet in the temple describing his sickness, and telling by what method the god had cured him. He again made suitable offerings at the temple, which were sometimes in the form of gold or silver representations of the diseased organ—a gold or silver model of a heart, hand, foot, etc.

Even the very early Greeks had learned something of anatomy. The daily contact with wounds and broken bones must of necessity lead to a crude understanding of anatomy in general. The first Greek anatomist, however, who is recognized as such, is said to have been Alcmaeon. He is said to have made extensive dissections of the lower animals, and to have described many hitherto unknown structures, such as the optic nerve and the Eustachian canal—the small tube leading into the throat from the ear. He is credited with many unique explanations of natural phenomena, such as, for example, the explanation that "hearing is produced by

the hollow bone behind the ear; for all hollow things are sonorous." He was a rationalist, and he taught that the brain is the organ of mind. The sources of our information about his work, however, are unreliable.

Democedes, who lived in the sixth century B.C., is the first physician of whom we have any trustworthy history. We learn from Herodotus that he came from Croton to Ægina, where, in recognition of his skill, he was appointed medical officer of the city. From Ægina he was called to Athens at an increased salary, and later was in charge of medical affairs in several other Greek cities. He was finally called to Samos by the tyrant Polycrates, who reigned there from about 536 to 522 B.C. But on the death of Polycrates, who was murdered by the Persians, Democedes became a slave. His fame as a physician, however, had reached the ears of the Persian monarch, and shortly after his capture he was permitted to show his skill upon King Darius himself. The Persian monarch was suffering from a sprained ankle, which his Egyptian surgeons had been unable to cure. Democedes not only cured the injured member but used his influence in saving the lives of his Egyptian rivals, who had been condemned to death by the king.

At another time he showed his skill by curing the queen, who was suffering from a chronic abscess of long standing. This so pleased the monarch that he offered him as a reward anything he might desire, except his liberty. But the costly gifts of Darius did not satisfy him so long as he remained a slave; and determined to secure his freedom at any cost, he volunteered to lead some Persian spies into his native country, promising to use his influence in converting some of the leading men of his nation to the Persian cause. Laden with the wealth that had been heaped upon him by Darius, he set forth

upon his mission, but upon reaching his native city of Croton he threw off his mask, renounced his Persian mission, and became once more a free Greek.

While the story of Democedes throws little light upon the medical practises of the time, it shows that paid city medical officers existed in Greece as early as the fifth and sixth centuries B. C. Even then there were different "schools" of medicine, whose disciples disagreed radically in their methods of treating diseases; and there were also specialists in certain diseases, quacks, and charlatans. Some physicians depended entirely upon external lotions for healing all disorders; others were "hydrotherapeutists" or "bath-physicians;" while there were a host of physicians who administered a great variety of herbs and drugs. There were also magicians who pretended to heal by sorcery, and great numbers of bone-setters, oculists, and dentists.

Many of the wealthy physicians had hospitals, or clinics, where patients were operated upon and treated. They were not hospitals in our modern understanding of the term, but were more like dispensaries, where patients were treated temporarily, but were not allowed to remain for any length of time. Certain communities established and supported these dispensaries for the care of the poor.

But anything approaching a rational system of medicine was not established until Hippocrates of Cos, the "father of medicine," came upon the scene. In an age that produced Phidias, Lysias, Herodotus, Sophocles, and Pericles, it seems but natural that the medical art should find an exponent who would rise above superstitious dogmas and lay the foundation for a medical science. His rejection of the supernatural alone stamps the greatness of his genius. But, besides this, he intro-

duced more detailed observation of diseases, and demonstrated the importance that attaches to prognosis.

Hippocrates was born at Cos about 460 B.C., but spent most of his life at Larissa, in Thessaly. He was educated as a physician by his father, and traveled extensively as an itinerant practitioner for several years. His travels in different climates and among many different people undoubtedly tended to sharpen his keen sense of observation. He was a practical physician as well as a theorist, and, withal, a clear and concise writer. "Life is short," he says, "opportunity fleeting, judgment difficult, treatment easy, but treatment after thought is proper and profitable."

His knowledge of anatomy was necessarily very imperfect, and was gained largely from his predecessors, to whom he gave full credit. Dissections of the human body were forbidden him, and he was obliged to confine his experimental researches to operations on the lower animals. His knowledge of the structure and arrangement of the bones, however, was fairly accurate, but the anatomy of the softer tissues, as he conceived it, was a queer jumbling together of blood-vessels, muscles, and tendons. He does refer to "nerves," to be sure, but apparently the structures referred to are the tendons and ligaments, rather than the nerves themselves.

He was better acquainted with the principal organs in the cavities of the body, and knew, for example, that the heart is divided into four cavities, two of which he supposed to contain blood, and the other two air.

His most revolutionary step was his divorcing of the supernatural from the natural, and establishing the fact that disease is due to natural causes and should be treated accordingly. The establishment of such a theory was naturally followed by close observation of the course



DEMOSTHENES ORATING BY THE SEASHORE

of diseases and the effects of treatment. To facilitate this, he introduced the custom of writing down his observations as he made them—the “clinical history” of the case. Such clinical records are in use all over the world today, and their importance is so obvious that it seems strange they should have fallen into disuse shortly after the time of Hippocrates, not to come into vogue again until almost two thousand years later.

Altho Hippocratic medicine rested on the belief in natural causes, nevertheless, dogma and theory held an important place. The *humoral* theory of disease was an all-important one, and so fully was this theory accepted that it influenced the science of medicine all through succeeding centuries.

According to this celebrated theory there are four humors in the body—blood, phlegm, yellow bile, and black bile. When these humors are mixed in exact proportions they constitute health; but any deviations from these proportions produce disease.

In treating diseases the aim of the physician was to discover which of these humors were out of proportion and to restore them to their natural equilibrium. It was the methods employed in this restitution, rather than a disagreement about the humors themselves, that resulted in the various “schools” of medicine.

In many ways the surgery of Hippocrates showed a better understanding of the structure of the organs than of their functions. Some of the surgical procedures as described by him are followed, with slight modifications, today. Many of his methods were entirely lost sight of until modern times, and one, the treatment of dislocation of the outer end of the collar-bone, was not revived until some time in the eighteenth century.

Hippocrates, it seems, like modern physicians, some-

times suffered from the ingratitude of his patients "The physician visits a patient suffering from fever or a wound, and prescribes for him," he says, "on the next day, if the patient feels worse the blame is laid upon the physician; if, on the other hand, he feels better nature is extolled, and the physician reaps no praise." The essence of this has been repeated in rime and prose by writers in every age and country, but the "father of medicine" cautions physicians against allowing it to influence their attitude toward their profession



THE AGE OF PERICLES



IX

THE VERSATILE ARISTOTLE

DOUBTLESS it has been noticed that our earlier thinkers were as far removed as possible from the limitations of specialism. In point of fact, in this early day, knowledge had not been classified as it came to be, later. The philosopher was, as his name implied, a lover of knowledge, and he did not find it beyond the reach of his capacity to apply himself to all departments of the field of human investigation.

It is nothing strange to discover that Anaximander and the Pythagoreans and Anaxagoras have propounded theories regarding the structure of the cosmos, the origin and development of animals and man, and the nature of matter itself.

Nowadays, so enormously involved has become the mass of mere facts regarding each of these departments of knowledge that no one man has the temerity to attempt to master them all. But it was different in those days of beginnings. Then the methods of observation were still crude, and it was quite the custom for a thinker of forceful personality to find an eager following among disciples who never thought of putting his theories to the test of experiment.

The great lesson that true science in the last resort depends upon observation and measurement, upon compass and balance, had not yet been learned, tho here and there a thinker like Anaxagoras had gained an inkling of it.

For the moment, indeed, there in Attica, which was now, thanks to that outburst of Periclean culture, the center of the world's civilization, the trend of thought was to take quite another direction. The very year which saw the birth of Democritus at Abdéra, and of Hippocrates, marked also the birth, at Athens, of another remarkable man, whose influence it would scarcely be possible to overestimate.

This man was Socrates.

The main facts of his history are familiar to every one. It will be recalled that Socrates spent his entire life in Athens, mingling everywhere with the populace; haranguing, so the tradition goes, every one who would listen; inculcating moral lessons, and finally incurring the disapprobation of at least a voting majority of his fellow-citizens. He gathered about him a company of remarkable men with Plato at their head, but this could not save him from the disapprobation of the multitudes, at whose hands he suffered death, legally administered after a public trial.

For the historian of metaphysics, Socrates marks an epoch, but for the historian of science he is a much less consequential figure.

Similarly regarding Plato, the aristocratic Athenian who sat at the feet of Socrates, and through whose writings the teachings of the master found widest currency. Some students of philosophy find in Plato "the greatest thinker and writer of all time." The student of science must recognize in him a thinker whose point of view was essentially non-scientific; one who tended always to reason from the general to the particular rather than from the particular to the general.

Plato's writings covered almost the entire field of thought, and his ideas were presented with such liter-



SOCRATES

ary charm that successive generations of readers turned to them with unflagging interest, and gave them wide currency through copies that finally preserved them to our own time.

Thus we are not obliged in his case, as we are in the case of every other Greek philosopher, to estimate his teachings largely from hearsay evidence. Plato himself speaks to us directly.

It is true, the literary form which he always adopted, namely, the dialog, does not give quite the same certainty as to when he is expressing his own opinions that a more direct narrative would have given; yet, in the main, there is little doubt as to the tenor of his own opinions—except, indeed, such doubt as always attaches to the philosophical reasoning of the abstract thinker.

The great ethical teacher had no significant message to give the world regarding the physical sciences. He apparently had no sharply defined opinions as to the mechanism of the universe; no clear conception as to the origin or development of organic beings; no tangible ideas as to the problems of physics; no favorite dreams as to the nature of matter. Virtually his back was turned on this entire field of thought. He was under the sway of those innate ideas which, as we have urged, were among the earliest inductions of science.

But he never for a moment suspected such an origin for these ideas. He supposed his conceptions of being, his standards of ethics, to lie back of all experience; for him they were the most fundamental and most dependable of facts.

He criticised Anaxagoras for having tended to deduce general laws from observation.

As we moderns see it, such criticism is the highest possible praise. It is a criticism that marks the distinc-

tion between the scientist who is also a philosopher and the philosopher who has but a vague notion of physical science.

Plato seemed, indeed, to realize the value of scientific investigation; he referred to the astronomical studies of the Egyptians and Chaldeans, and spoke hopefully of the results that might accrue were such studies to be taken up by that Greek mind which, as he justly conceived, had the power to vitalize and enrich all that it touched. But he told here of what he would have others do, not of what he himself thought of doing. His voice was prophetic, but it stimulated no worker of his own time.

When we pass to that third great Athenian teacher, Aristotle, the case is far different. Here was a man whose name was to be received as almost a synonym for Greek science for more than a thousand years after his death. All through the Middle Ages his writings were to be accepted as virtually the last word regarding the problems of nature. His followers actually preferred his mandate to the testimony of their own senses.

It is perhaps not too much to say that the name of Aristotle stands, even in our own time, as vaguely representative in the popular mind of all that was highest and best in the science of antiquity. Yet perhaps it would not be going too far to assert that something like a reversal of this judgment would be nearer the truth. Aristotle did, indeed, bring together a great mass of facts regarding animals in his work on natural history, which, being preserved, has been deemed to entitle its author to be called the "father of zoology." But there is no reason to suppose that any considerable portion of this work contained matter that was novel, or recorded observations that were original with Aristotle:

and the classifications there outlined are at best but a vague foreshadowing of the elaboration of the science.

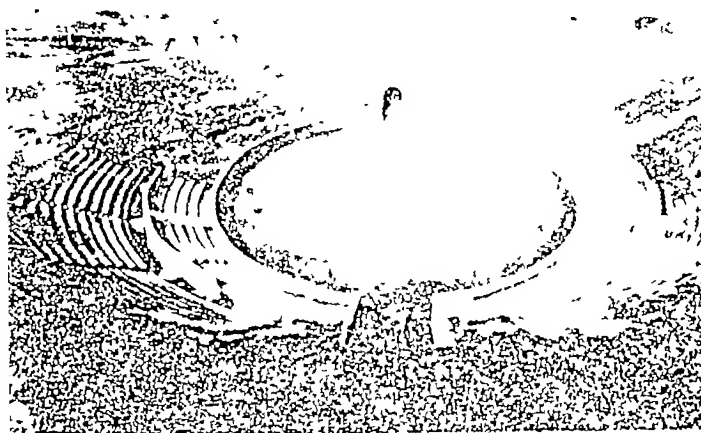
Such as it is, however, the natural history stands to the credit of the Stagirite.

He must be credited, too, with a clear enunciation of one most important scientific doctrine — namely, the doctrine of the spherical figure of the earth. We have already seen that this theory originated with the Pythagorean philosophers out in Italy. We have seen, too, that the doctrine had not made its way in Attica in the time of Anaxagoras. But in the intervening century it had gained wide currency, else so essentially conservative a thinker as Aristotle would scarcely have accepted it.

He did accept it, however, and gave the doctrine clearest and most precise expression. Here are his words:

"As to the figure of the earth it must necessarily be spherical. . . . If it were not so, the eclipses of the moon would not have such sections as they have. For in the configurations in the course of a month the deficient part takes all different shapes; it is straight, and concave, and convex; but in eclipses it always has the line of divisions convex; wherefore, since the moon is eclipsed in consequence of the interposition of the earth, the periphery of the earth must be the cause of this by having a spherical form,

"And again, from the appearance of the stars it is clear, not only that the earth is round, but that its size is not very large; for when we make a small removal to the south or the north, the circle of the horizon becomes palpably different, so that the stars overhead undergo a great change, and are not the same to those that travel in the north and to the south. For some stars are seen in Egypt or at Cyprus, but are not seen in the



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countries to the north of these; and the stars that in the north are visible while they make a complete circuit, there undergo a setting.

"So that from this it is manifest, not only that the form of the earth is round, but also that it is a part of a not very large sphere; for otherwise the difference would not be so obvious to persons making so small a change of place.

"Wherefore we may judge that those persons who connect the region in the neighborhood of the pillars of Hercules with that toward India, and who assert that in this way the sea is one, do not assert things very improbable. They confirm this conjecture moreover by the elephants, which are said to be of the same species toward each extreme; as if this circumstance was a consequence of the conjunction of the extremes.

"The mathematicians who try to calculate the measure of the circumference, make it amount to four hundred thousand stadia; whence we collect that the earth is not only spherical, but is not large compared with the magnitude of the other stars."

But in giving full meed of praise to Aristotle for the promulgation of this doctrine of the sphericity of the earth, it must unfortunately be added that the conservative philosopher paused without taking one other important step. He could not accept, but, on the contrary, he expressly repudiated, the doctrine of the earth's motion. This idea also was a part of the Pythagorean doctrine. It has even been contended by some critics that it was the adverse conviction of the Peripatetic philosopher which, more than any other single influence, tended to retard the progress of the true doctrine regarding the mechanism of the heavens.

Aristotle accepted the sphericity of the earth, and that

doctrine became a commonplace of scientific knowledge, and so continued throughout classical antiquity.

But Aristotle rejected the doctrine of the earth's motion, and that doctrine, tho promulgated actively by a few contemporaries and immediate successors of the Stagirite, was then doomed to sink out of view for more than a thousand years.

If it be a correct assumption that the influence of Aristotle was in large measure responsible for this result, then we shall perhaps not be far astray in assuming that the great founder of the Peripatetic school was, on the whole, more instrumental in retarding astronomical science than any other one man that ever lived.

The field of science in which Aristotle was preeminently a pathfinder is zoology. His writings on natural history have largely been preserved, and they constitute by far the most important contribution to the subject that has come down to us from antiquity. They show us that Aristotle had gained possession of the widest range of facts regarding the animal kingdom, and, what is far more important, had attempted to classify these facts.

In so doing he became the founder of systematic zoology.

Aristotle's classification of the animal kingdom was known and studied throughout the Middle Ages, and, in fact, remained in vogue until superseded by that of Cuvier in the nineteenth century. It is not to be supposed that all the terms of Aristotle's classification originated with him. Some of the divisions are too patent to have escaped the observation of his predecessors. Thus, for example, the distinction between birds and fishes as separate classes of animals is so obvious that it must appeal to a child or to a savage.



SPRING FESTIVAL AT ATHENS — DIOGENES
AND ALEXANDER

But the efforts of Aristotle extended to less patent generalizations. At the very outset, his grand division of the animal kingdom into blood-bearing and bloodless animals implies a very broad and philosophical conception of the entire animal kingdom. The modern physiologist does not accept the classification, inasmuch as it is now known that colorless fluids perform the functions of blood for all the lower organisms.

But the fact remains that Aristotle's grand divisions correspond to the grand divisions of the Lamarckian system—vertebrates and invertebrates—which every one now accepts.

Aristotle, as we have said, based his classification upon observation of the blood; Lamarck was guided by a study of the skeleton. The fact that such diverse points of view could direct the observer toward the same result gives, inferentially, a suggestive lesson in what the modern physiologist calls the homologies of parts of the organism.

Aristotle divides his so-called blood-bearing animals into five classes: (1) Four-footed animals that bring forth their young alive; (2) birds; (3) egg-laying four-footed animals (including what modern naturalists call reptiles and amphibians); (4) whales and their allies; (5) fishes.

This classification, it will be observed, is not so very far afield from the modern divisions into mammals, birds, reptiles, amphibians, and fishes.

That Aristotle should have recognized the fundamental distinction between fishes and the fish-like whales, dolphins, and porpoises proves the far from superficial character of his studies.

Aristotle knew that these animals breathe by means of lungs and that they produce living young. He

recognized, therefore, their affinity with his first class of animals, even if he did not, like the modern naturalist, consider these affinities close enough to justify bringing the two types together into a single class.

The bloodless animals were also divided by Aristotle into five classes—namely: (1) Cephalopoda (the octopus, cuttle-fish, etc.); (2) weak-shelled animals (crabs, etc.); (3) insects and their allies (including various forms, such as spiders and centipedes, which the modern classifier prefers to place by themselves); (4) hard-shelled animals (clams, oysters, snails, etc.); (5) a conglomerate group of marine forms, including star-fish, sea-urchins, and various anomalous forms that were regarded as linking the animal to the vegetable worlds.

This classification of the lower forms of animal life continued in vogue until Cuvier substituted for it his famous grouping into articulates, mollusks, and radiates; which grouping in turn was in part superseded later in the nineteenth century.

What Aristotle did for the animal kingdom his pupil, Theophrastus, did in some measure for the vegetable kingdom.

Theophrastus, however, was much less a classifier than his master, and his work on botany, called *The Natural History of Development*, pays comparatively slight attention to theoretical questions. It deals largely with such practicalities as the making of charcoal, of pitch, and of resin, and the effects of various plants on the animal organism when taken as foods or as medicines.

It remained, however, throughout antiquity as the most important work on its subject, and it entitles Theophrastus to be called the "father of botany."





THE LAST DAYS OF CORINTH

X

STRABO THE GEOGRAPHER

WE have seen that the third century B.C. was a time when Alexandrian science was at its height. The second century produced also in Hipparchus at least one investigator of the very first rank; tho, to be sure, Hipparchus can be called an Alexandrian only by courtesy.

In the ensuing generations the Greek capital at the mouth of the Nile continued to hold its place as the center of scientific and philosophical thought. The kingdom of the Ptolemies still flourished with at least the outward appearance of its old-time glory, and a company of grammarians and commentators of no small merit could always be found in the service of the famous museum and library; but the whole aspect of world-history was rapidly changing. Greece, after her brief day of political supremacy, was sinking rapidly into desuetude, and the hard-headed Roman in the West was making himself master everywhere.

While Hipparchus of Rhodes was in his prime, Corinth, the last stronghold of the mainland of Greece, had fallen before the prowess of the Roman, and the kingdom of the Ptolemies, tho still nominally free, had begun to come within the sphere of Roman influence.

Just what share these political changes had in changing the aspect of Greek thought is a question regarding which there might be difference of opinion; but there can be no question that, for one reason or another, the

Alexandrian school as a creative center went into a rapid decline at about the time of the Roman rise to world power.

There are some distinguished names, but, as a general rule, the spirit of the times is reminiscent rather than creative; the workers tend to collate the researches of their predecessors rather than to make new and original researches for themselves. Eratosthenes, the inventive world-measurer, was succeeded by Strabo, the industrious collator of facts; Aristarchus and Hipparchus, the originators of new astronomical methods, were succeeded by Ptolemy, the perfecter of their methods and the systematizer of their knowledge.

Meanwhile, in the West, Rome never became a true culture center. The great genius of the Roman was political; the Augustan Age produced a few great historians and poets, but not a single great philosopher or creative devotee of science. Cicero, Lucian, Seneca, Marcus Aurelius, give us at best a reflection of Greek philosophy. Pliny, the one world-famous name in the scientific annals of Rome, can lay claim to no higher credit than that of a marvelously industrious collector of facts—the compiler of an encyclopedia which contains not one creative touch.

All in all, then, this epoch of Roman domination is anti-climactic. With the culmination of Greek effort in the so-called Hellenistic period we have seen ancient science at its peak. The Roman period is but a time of transition. Yet we cannot quite disregard the efforts of such workers as those just named.

The earliest in point of time is Strabo. This most famous of ancient geographers was born in Amasia, Pontus, about 63 B.C., and lived to the year 24 A.D., living, therefore, in the age of Cæsar and Augustus, during

which the final transformation in the political position of the kingdom of Egypt was effected.

The name of Strabo in a modified form has become popularized through a curious circumstance. The geographer, it appears, was afflicted with a peculiar squint of the eyes, hence the name *strabismus*, which the modern oculist applies to that particular infirmity.

Fortunately, the famed geographer has not been forced to depend upon hearsay evidence for recognition. His comprehensive work on geography has been preserved in its entirety, being one of the few expansive classical writings of which this is true. The other writings of Strabo, however, including certain histories of which reports have come down to us, are entirely lost.

The geography is in many ways a remarkable book. It is not, however, a work in which any important new principles are involved. Rather is it typical of its age in that it is an elaborate compilation and a critical review of the labors of Strabo's predecessors. Doubtless it contains a vast deal of new information as to the details of geography—precise areas and distance, questions of geographical locations as to latitude and zones, and the like. But however important these details may have been from a contemporary standpoint, they, of course, can have nothing more than historical interest to posterity.

The value of the work is chiefly due to the criticisms which Strabo passes upon his fore-runners, and to the incidental historical and scientific references with which his work abounds. Being written in this closing period of ancient progress, and summarizing, as it does, in full detail the geographical knowledge of the time, it serves as an important guide-mark for the student of the progress of scientific thought.



ROMAN TRADITIONS: HORATIUS KEEPS
THE BRIDGE
TRIPLE DUEL OF HORATII AND CURIATII

"As the size of the earth," he says, "has been demonstrated by other writers, we shall here take for granted and receive as accurate what they have advanced. We shall also assume that the earth is spheroidal, that its surface is likewise spheroidal and, above all, that bodies have a tendency toward its center, which latter point is clear to the perception of the most average understanding.

"However, we may show summarily that the earth is spheroidal, from the consideration that all things, however distant, tend to its center, and that every body is attracted toward its center by gravity.

"This is more distinctly proved from observations of the sea and sky, for here the evidence of the senses and common observation is alone requisite.

"The convexity of the sea is a further proof of this to those who have sailed, for they cannot perceive lights at a distance when placed at the same level as their eyes, and if raised on high they at once become perceptible to vision tho at the same time farther removed. So when the eye is raised it sees what before was utterly imperceptible Homer speaks of this when he says:

Lifted up on the vast wave he quickly beheld afar.

Sailors as they approach their destination behold the shore continually raising itself to their view, and objects which had at first seemed low begin to lift themselves.

"Our gnomons, also, are, among other things, evidence of the revolution of the heavenly bodies, and common-sense at once shows us that if the depth of the earth were infinite such a revolution could not take place."

Elsewhere Strabo criticizes Eratosthenes for having entered into a long discussion as to the form of the earth. This matter, Strabo thinks, "should have been disposed of in the compass of a few words." Obviously this doctrine of the globe's sphericity had, in the course of 600 years, become so firmly established among the Greek thinkers as to seem almost axiomatic. The Western world was to make a curious recession from this seemingly secure position under stimulus of an Oriental misconception.

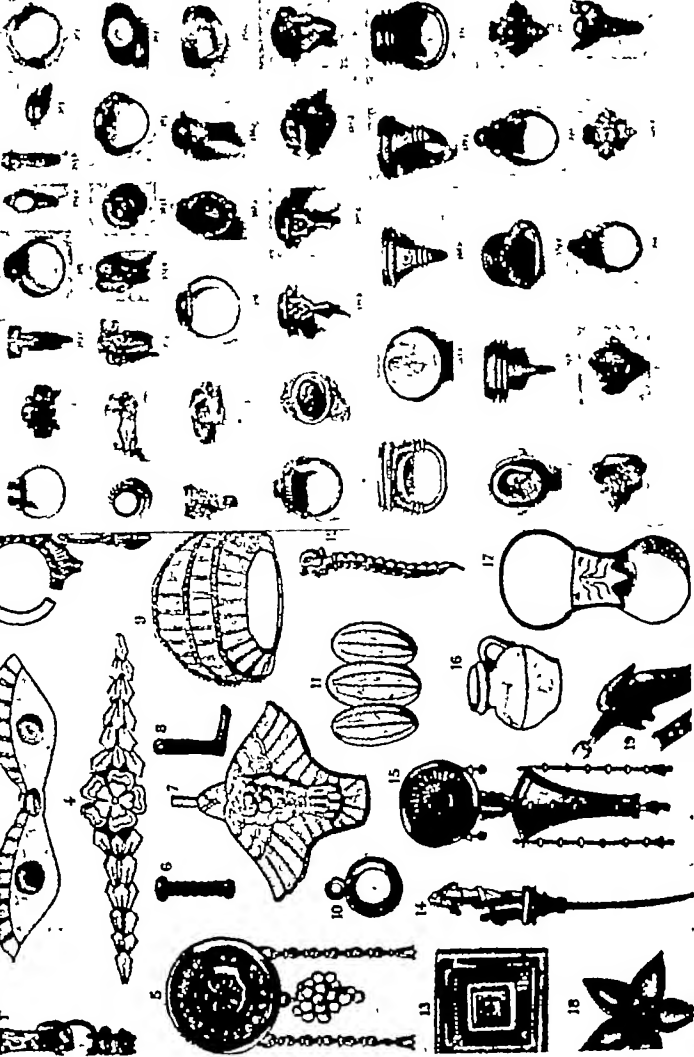
As to the size of the globe, Strabo is disposed to accept without particular comment the measurements of Eratosthenes. He speaks, however, of "more recent measurements," referring in particular to that adopted by Posidonius, according to which the circumference is only about one hundred and eighty thousand stadia.

Posidonius, we may note in passing, was a contemporary and friend of Cicero, and hence lived shortly before the time of Strabo. His measurement of the earth was based on observations of a star which barely rose above the southern horizon at Rhodes as compared with the height of the same star when observed at Alexandria.

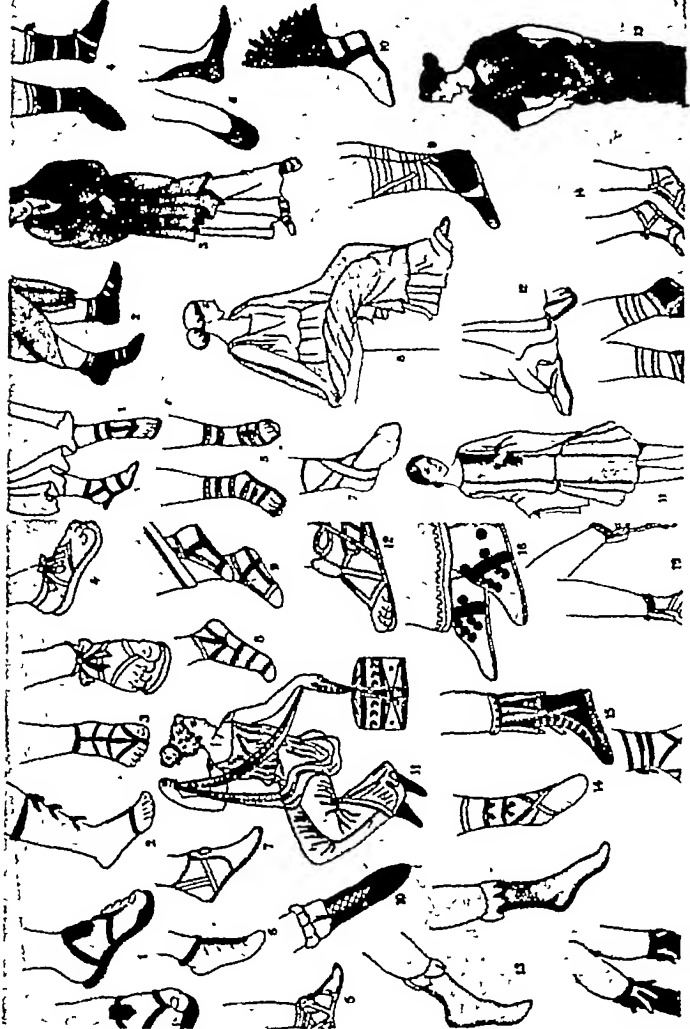
This measurement of Posidonius, together with the even more famous measurement of Eratosthenes, appears to have been practically the sole guide as to the size of the earth throughout the later periods of antiquity, and, indeed, until the later Middle Ages.

As becomes a writer who is primarily geographer and historian rather than astronomer, Strabo shows a much keener interest in the habitable portions of the globe than in the globe as a whole. He assures us that this habitable portion of the earth is a great island, "since wherever men have approached the termination of the land, the sea, which we designate ocean, has been met with, and

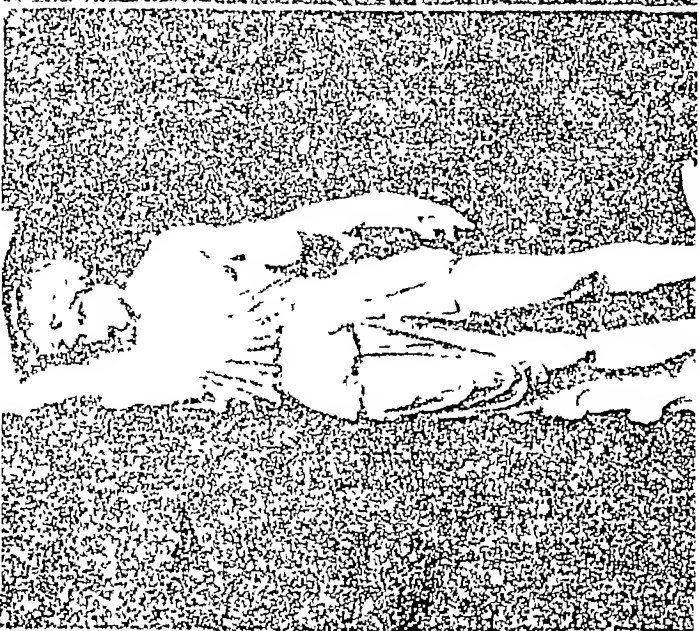
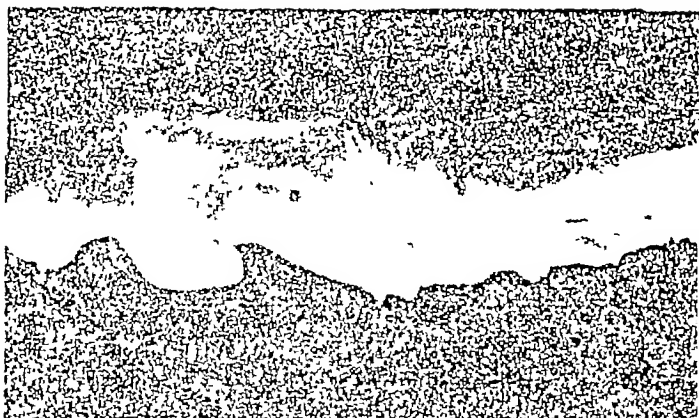


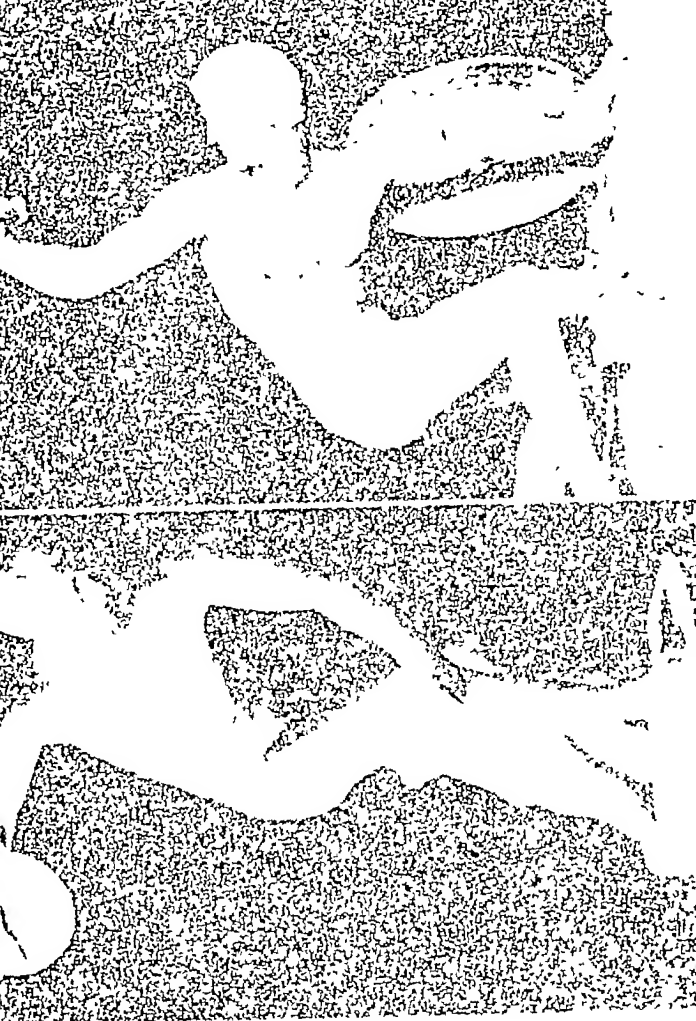


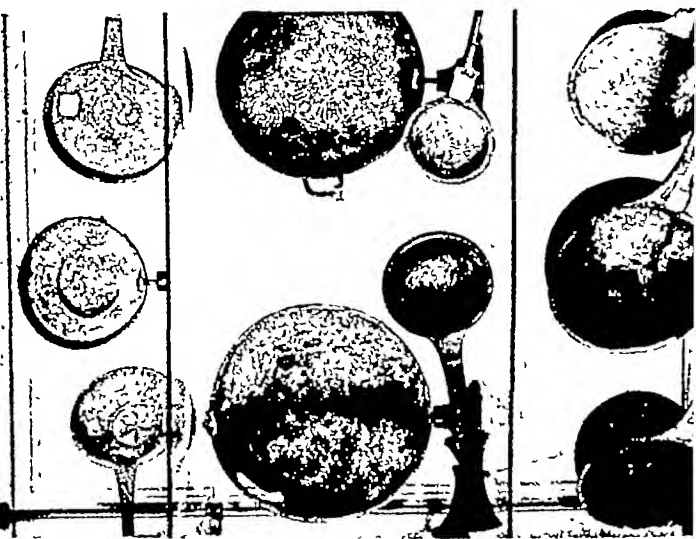
ROMAN ORNAMENTS



ROMAN COSTUMES







ROMAN IMPLEMENTS FROM POMPEII

reason assures us of the similarity of this place which our senses have not been tempted to survey." He points out that whereas sailors have not circumnavigated the globe, they had not been prevented from doing so by any continent; and it seems to him altogether unlikely that the Atlantic Ocean is divided into two seas by narrow isthmuses so placed as to prevent circumnavigation. "How much more probable that it is confluent and uninterrupted. This theory," he adds, "goes better with the ebb and flow of the ocean. Moreover (and here his reasoning becomes more fanciful), the greater the amount of moisture surrounding the earth, the easier would the heavenly bodies be supplied with vapor from thence."

Yet he is disposed to believe, following Plato, that the tradition "concerning the island of Atlantis might be received as something more than idle fiction, it having been related by Solon, on the authority of the Egyptian priests, that this island, almost as large as a continent, was formerly in existence altho now it had disappeared "

In a word, then, Strabo entertains no doubt whatever that it would be possible to sail around the globe from Spain to India. Indeed, so matter-of-fact an inference was this that the feat of Columbus would have seemed less surprizing in the first century of our era than it did when actually performed in the fifteenth century. The terrors of the great ocean held the mariner back, rather than any doubt as to where he would arrive at the end of the voyage.

Coupled with the idea that the habitable portion of the earth is an island, there was linked a tolerably definite notion as to the shape of this island. This shape Strabo likens to a military cloak. The comparison does not seem peculiarly apt when we are told presently

that the length of the habitable earth is more than twice its breadth. This idea, Strabo assures us, accords with the most accurate observations "both ancient and modern."

These observations seemed to show that it is not possible to live in the region close to the equator, and that, on the other hand, the cold temperature sharply limits the habitability of the globe toward the north.

All the civilization of antiquity clustered about the Mediterranean, or extended off toward the east at about the same latitude. Hence geographers came to think of the habitable globe as having the somewhat lenticular shape which a crude map of these regions suggests. The constant references of Strabo impress upon us the thought that this long, relatively narrow area of the earth's surface is the only one which can be conceived of as habitable.

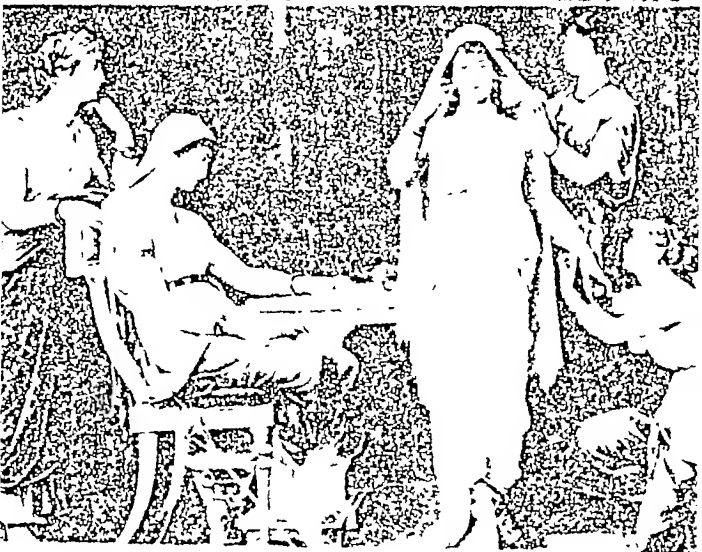
Strabo had much to tell us concerning zones, which, following Posidonius, he believes to have been first described by Parmenides. We may note, however, that other traditions assert that both Thales and Pythagoras had divided the earth into zones. The number of zones accepted by Strabo is five, and he criticizes Polybius for making the number six. The five zones accepted by Strabo are as follows: the uninhabitable torrid zone lying in the region of the equator; a zone on either side of this extending to the tropic; and then the temperate zones extending in either direction from the tropic to the arctic regions. There seems to have been a good deal of dispute among the scholars of the time as to the exact arrangement of these zones, but the general idea that the north-temperate zone is the part of the earth with which the geographer deals seemed clearly established. That the south-temperate zone would also pre-

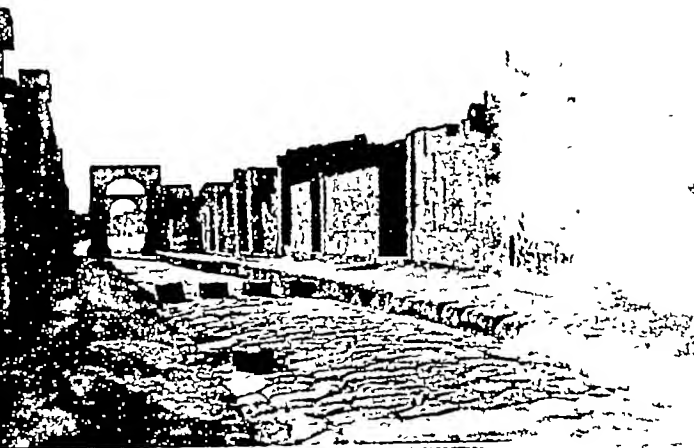
sent a habitable area is an idea that is sometimes suggested, tho seldom or never distinctly expressed.

In leaving the great geographer we may emphasize his point of view and that of his contemporaries by quoting three fundamental principles which he reiterates as being among the "facts established by natural philosophers." He tells us that "(1) The earth and heavens are spheroidal (2) The tendency of all bodies having weight is toward a center. (3) Further, the earth being spheroidal and having the same center as the heavens, is motionless, as well as the axis that passes through both it and the heavens. The heavens turn round both the earth and its axis, from east to west. The fixed stars turn round with it at the same rate as the whole. These fixed stars follow in their course parallel circles, the principal of which are the equator, two tropics, and the arctic circles; while the planets, the sun, and the moon describe certain circles comprehended within the zodiac."

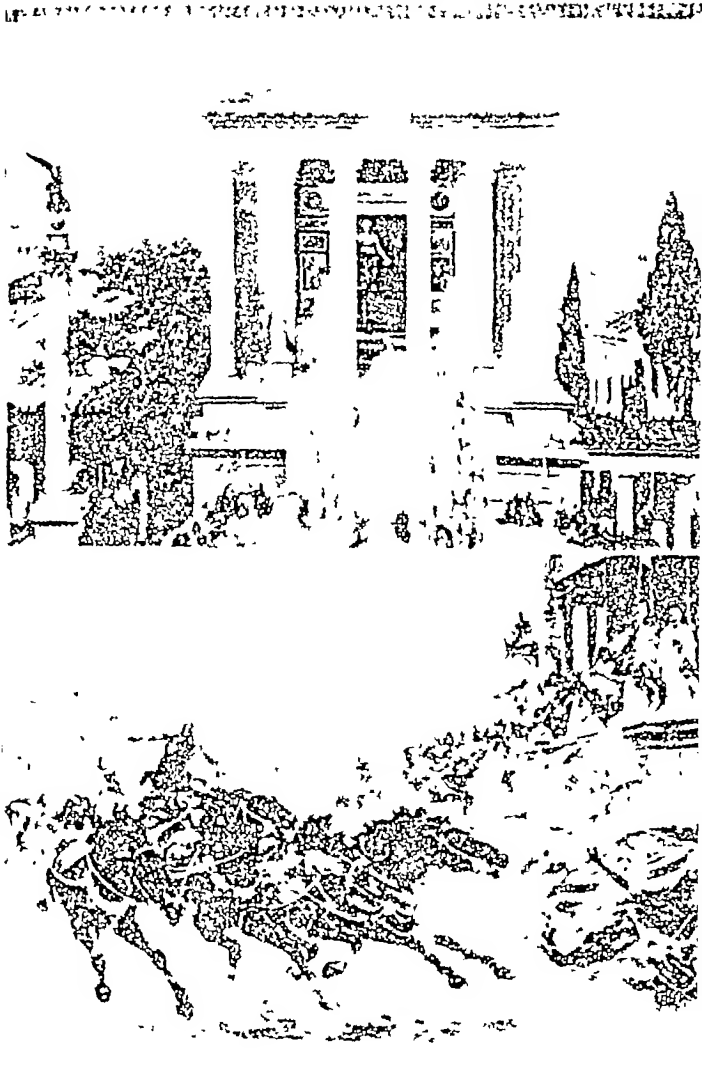
Here, then, is a curious mingling of truth and error. The Pythagorean doctrine that the earth is round had become a commonplace, but it would appear that the theory of Aristarchus, according to which the earth is in motion, had been almost absolutely forgotten. Strabo does not so much as refer to it; neither is it treated with greater respect by the other writers of the period.







POMPEII EXCAVATION AND A PUPPET SHOW





CLEOPATRA AND CLEOPATRA

XI

TWO FAMOUS EXPOSITORS—PLINY AND PTOLEMY

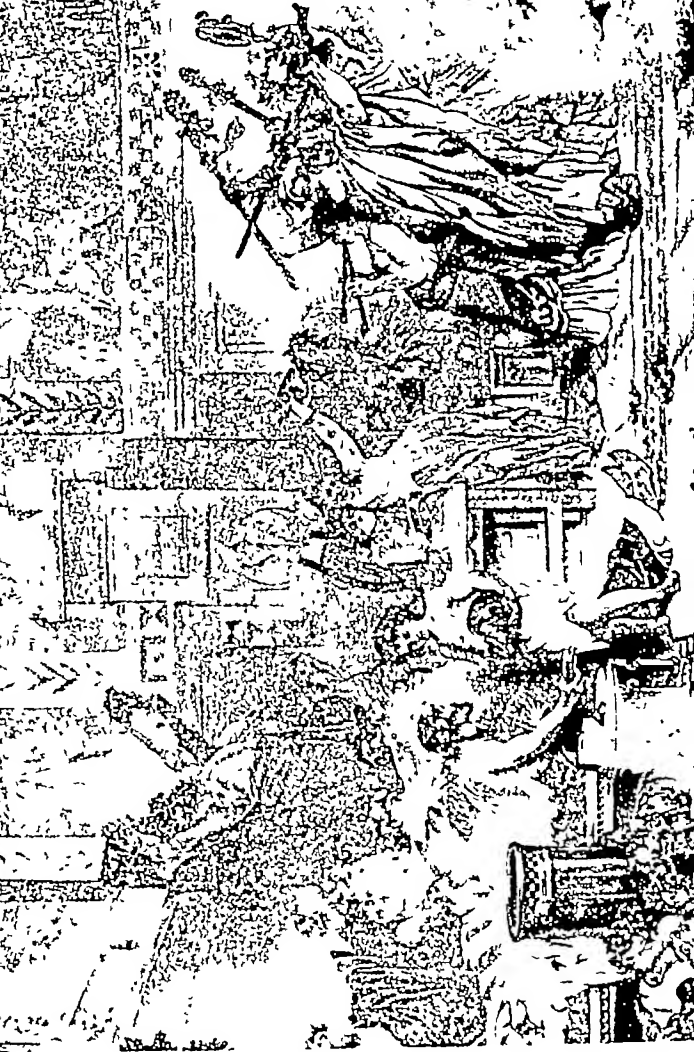
WHILE Strabo was pursuing his geographical studies at Alexandria, a young man came to Rome who was destined to make his name more widely known in scientific annals than that of any other Latin writer of antiquity.

This man was Plinius Secundus, who, to distinguish him from his nephew, a famous writer in another field, is usually spoken of as Pliny the Elder.

There is a famous story to the effect that the great Roman historian Livy on one occasion addressed a casual associate in the amphitheater at Rome, and on learning that the stranger hailed from the outlying Spanish province of the empire, remarked to him, "Yet you have doubtless heard of my writings even there." "Then," replied the stranger, "you must be either Livy or Pliny."

The anecdote illustrates the wide fame which the Roman naturalist achieved in his own day. And the records of the Middle Ages show that this popularity did not abate in succeeding times. Indeed, the *Natural History* of Pliny is one of the comparatively few bulky writings of antiquity that the efforts of copyists have preserved to us almost entire.

It is a remarkable work and eminently typical of its time; but its author was an industrious compiler, not a creative genius. As a monument of industry it has sel-



ROMAN FESTIVAL





dom been equaled, and in this regard it seems the more remarkable inasmuch as Pliny was a practical man of affairs who occupied most of his life as a soldier fighting the battles of the empire.

He compiled his book in the leisure hours stolen from sleep, often writing by the light of the camp-fire. Yet he cites or quotes from about four thousand works, most of which are known to us only by his references.

Doubtless Pliny added much through his own observations. We know how keen was his desire to investigate, since he lost his life through attempting to approach the crater of Vesuvius on the occasion of that memorable eruption which buried the cities of Herculaneum and Pompeii.

Doubtless the wandering life of the soldier had given Pliny abundant opportunity for personal observation in his favorite fields of botany and zoology. But the records of his own observations are so intermingled with knowledge drawn from books that it is difficult to distinguish the one from the other. Nor does this greatly matter, for whether as closet-student or field-naturalist, Pliny's trait of mind is essentially that of the compiler. He was no philosophical thinker, no generalizer, no path-maker in science. He lived at the close of a great progressive epoch of thought; in one of those static periods when numberless observers piled up an immense mass of details which might advantageously be sorted into a kind of encyclopedia.

Such an encyclopedia is the so-called *Natural History* of Pliny. It is a vast jumble of more or less uncritical statements regarding almost every field of contemporary knowledge. He seems disposed to quote any interesting citation that he comes across in his omnivorous readings, shielding himself behind an equivocal "it is

said," or "so and so alleges." A single illustration will suffice to show what manner of thing is thought worthy of repetition.

"It is asserted," he says, "that if the fish called a sea-star is smeared with the fox's blood and then nailed to the upper lintel of the door, or to the door itself, with a copper nail, no noxious spell will be able to obtain admittance, or, at all events, be productive of any ill effects."

It is easily comprehensible that a work fortified with such practical details as this should have gained wide popularity. Doubtless the natural histories of our own day would find readier sale were they to pander to various superstitions not altogether different from that here suggested. The man, for example, who believes that to have a black cat cross his path is a lucky omen would naturally find himself attracted by a book which took account of this and similar important details of natural history.

Perhaps, therefore, it was its inclusion of absurdities, quite as much as its legitimate value, that gave vogue to the celebrated work of Pliny.

But be that as it may, the most famous scientist of Rome must be remembered as a popular writer rather than as an experimental worker. In the history of the promulgation of scientific knowledge his work is important; in the history of scientific principles it may virtually be disregarded.

Almost the same thing may be said of Ptolemy, an even more celebrated writer, who was born not very long after the death of Pliny. The exact dates of Ptolemy's life are not known, but his recorded observations extend to the year 151 A.D.

He was a working astronomer, and he made at least



CÆSAR TAKES CALPURNIA TO WIFE



Costume. Roman

Plutarch

ROMAN MATRON AND CHILD

one original discovery of some significance—namely, the observation of a hitherto unrecorded irregularity of the moon's motion, which came to be spoken of as the moon's evection. This consists of periodical aberrations from the moon's regular motion in its orbit, which, as we now know, are due to the gravitation pull of the sun, but which remained unexplained until the time of Newton.

Ptolemy also made original observations as to the motions of the planets. He is, therefore, entitled to a respectable place as an observing astronomer; but his chief fame rests on his writings.

His great works have to do with geography and astronomy. In the former field he makes an advance upon Strabo, citing the latitude of no fewer than five thousand places. In the field of astronomy, his great service was to have made known to the world the labors of Hipparchus. Ptolemy has been accused of taking the star-chart of his great predecessor without due credit, and indeed it seems difficult to clear him of this charge. Yet it is at least open to doubt whether he intended any impropriety, inasmuch as he all along is sedulous in his references to his predecessor. Indeed, his work might almost be called an exposition of the astronomical doctrines of Hipparchus.

No one pretends that Ptolemy is to be compared with the Rhodesian observer as an original investigator, but as a popular expounder his superiority is evidenced in the fact that the writings of Ptolemy became practically the sole astronomical text-book of the Middle Ages both in the East and in the West, while the writings of Hipparchus were allowed to perish.

The most noted of all the writings of Ptolemy is the work which became famous under the Arabic name of

Almagest. This word is curiously derived from the Greek title *ἡ μεγίστη σύνταξις*, "the greatest construction," a name given the book to distinguish it from a work on astrology in four books by the same author. For convenience of reference it came to be spoken of merely as *ἡ μεγίστη*, from which the Arabs form the title *Tabair al Magisthi*, under which title the book was published in the year 827. From this it derived the word *Almagest*, by which Ptolemy's work continued to be known among the Arabs, and subsequently among Europeans when the book again became known in the West.

Ptolemy's book, as has been said, is virtually an elaboration of the doctrines of Hipparchus. It assumes that the earth is the fixed center of the solar system, and that the stars and planets revolve about it in twenty-four hours, the earth being, of course, spherical.

It was not to be expected that Ptolemy should have adopted the heliocentric idea of Aristarchus. Yet it is much to be regretted that he failed to do so, since the deference which was accorded his authority throughout the Middle Ages would doubtless have been extended in some measure at least to this theory as well, had he championed it. Contrariwise, his unqualified acceptance of the geocentric doctrine sufficed to place that doctrine beyond the range of challenge.

The *Almagest* treats of all manner of astronomical problems, but the feature of it which gained it widest celebrity was perhaps that which has to do with eccentrics and epicycles. This theory was, of course, but an elaboration of the ideas of Hipparchus; but, owing to the celebrity of the expositor, it has come to be spoken of as the theory of Ptolemy.

With both Hipparchus and Ptolemy, the theory of



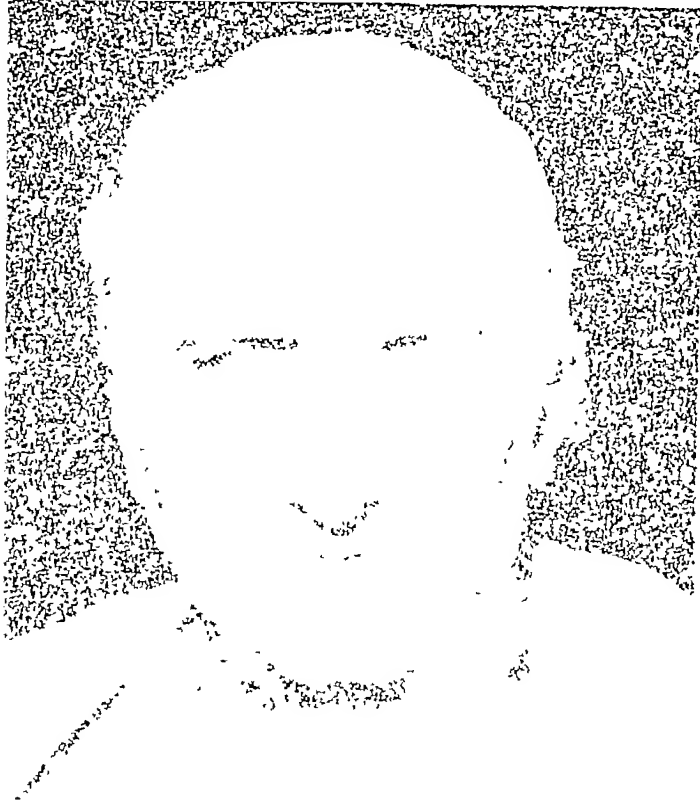


SCULPTURED HEAD OF JUPITER OLYMPUS





SCULPTURED HEAD OF JUPITER OLYMPUS



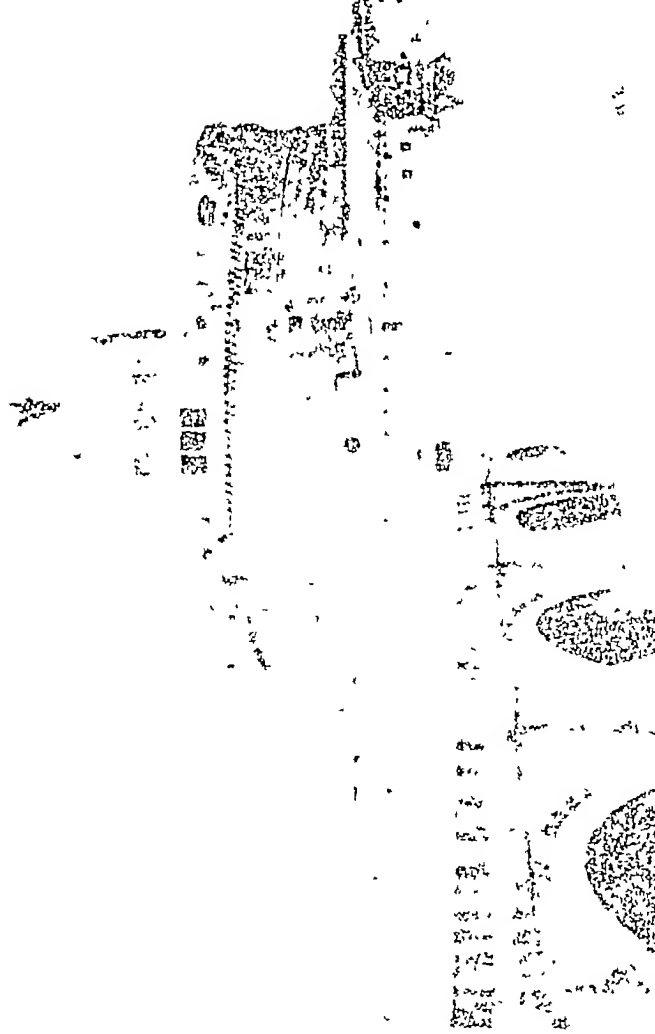


CICERO AGAINST CATILINE





TIBERIUS AT CAPRI





A talis bore seu tyrannus
 bescit capu conuulsu impo
 trūq; nisi incredibili modo
 onferat astutus iouis impio
 uela summo resurgens
 ripuit nolueris q; fati
 Tandem alas cū ipso frequens
 A etiam tectis tū crepus sonum
 cecidit illapsus cecidit
 uisilerat, nisi famulo iectum
 cetera leuasset mortalium
 uisus uiror. reddere uictimas
 ceteri q; nouam momento
 os humilem ferientis agna
 uideamus manens edax dicola distrophes hypotruet
Ion cbur neq; autem parantur ap quod si sic noie
 occa reuocet ur como hancat seglapu
 Non trates hymeie
 remunt columnas ultima rella
 affici. neq; attali
 gnotus heres regum occupati
 et hancas michi
 tabunt bonste purpuris dantes
 et fides et ingenu
 onguia uera est impere q; dūto
 c penit. et nichil supra
 co licet nec potest amari
 inglori flagito
 ans te mis uincis libinis
 Anditur dies die
 Non q; pergunt mure lime
 ulet. marmoza
 acis sub ipm funia et sepulcr
 memor stans domos
 co ans q; hūis obstrpentis inges

Handwritten text in a cursive script, likely a letter or document. The text is written on a piece of paper that is heavily stained and discolored, with significant ink bleed-through visible from the reverse side. The handwriting is dense and fills most of the page.

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XII

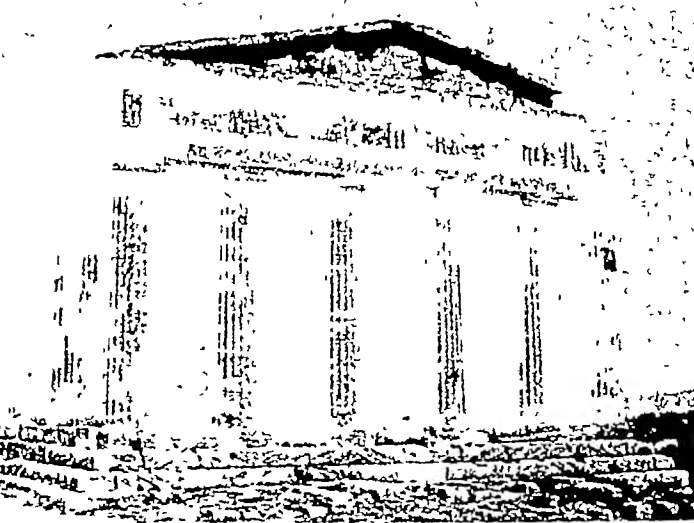
GREEK DOCUMENTS FROM EGYPT

DURING the reign of the Ptolemies, Egypt was the land of books. The founder of the dynasty, the first Ptolemy, was himself the author of the most authoritative history of Alexander, whom he had accompanied as a trusted lieutenant in all his conquests; and the succeeding rulers for about three centuries maintained with extraordinary uniformity the traditions of scholarship which from the first attached to Alexandria, the capital of the kingdom.

Throughout this period Alexandria may be said to have been the culture center of the world. Athens, it is true, still retained something of the glamor of its former greatness, and Pergamus, the capital of the Seleucian Kingdom, attempted for a long time to rival the Egyptian city; but it cannot be said that the supremacy of Alexandria was ever fairly challenged.

The civilization of the Egyptian city throughout this period was essentially Greek. The greatness of Egypt was only reminiscent, and tho occasionally one hears of an Egyptian scholar, such as Manetho, who wrote the famous *History of the Egyptian Dynasties*, the main body of writers and scholars of the time were Greeks, and the official language of the country was naturally that of its now dominant conquerors.

Doubtless a large proportion of the native population never adopted or learned the Greek language. Such official documents as the Rosetta Stone, with its trilin-



GREEK TEMPLE AND ROMAN AQUEDUCT

gual inscription in hieroglyphics, demotic script, and Greek, show that the king was obliged to resort to the native script and the ancient language in order to reach all his subjects.

None the less is it true that the coterie of brilliant men who gathered about the court of Alexandria, and made that city famous as the center of culture for a long epoch, were Greeks, speaking and writing a language little modified from the language of Herodotus, Sophocles, and Æschylus; a language, in short, only modified from that of classical Greece of the Golden Age in so far as every tongue must change in the course of several generations.

The institution that gave, as it were, the official stamp to the culture of Ptolemaic Egypt was the famous library at Alexandria. There were, in fact, several notable Alexandrian libraries. The first of these, collected by the early Ptolemies and added to by one after another, had come in the day of Cleopatra to have, so it is alleged, about 700,000 volumes. It is easy to exaggerate in citing numbers where there are no possible means of verification, and he would be a rash statistician who should claim for this computation any great validity as a close estimate of the size of the first Alexandrian Library. That it was a monster collection of books, however, cannot be in the least questioned, and when Cæsar, as a means of self-protection, set fire to it, or rather to his ships, from which the fire soon spread to the library, no doubt there went up in flames and smoke a mass of material bearing on the history of antiquity that never has been, and never could be, restored.

It is wonderful, however, how quickly a new library sprang into being in place of the old. A love of books, once acquired, is a persistent infatuation, and one can

readily understand, if one cannot quite condone, the act by which Mark Antony laid the broad foundations for the new Alexandrian Library. Wishing to please Cleopatra, the Roman general, now taking the place in the affections of the Egyptian queen once held by Cæsar, transported bodily from Pergamus all the treasures of the library of King Eumenes.

This library is said to have consisted of 200,000 volumes. However large the overestimate, at least the number was sufficient to make a respectable start for the Alexandrian Library which Cleopatra established in the Serapeum, or Temple of Serapis.

This new Alexandrian Library soon became quite as famous as the old. It was added to for about three centuries, was scattered in A.D. 390 by the fanatic Theophilus, patriarch of Alexandria under Theodosius the Great; was re-collected in part and added to again for another term of about three centuries, and finally was wilfully destroyed, so it has often been alleged, in the year 640 A.D., by the Arab conquerors who gave the death-blow to Greek civilization in Egypt.

Again we hear the number 700,000 named as telling the list of books in the Alexandrian Library at the time of the Arab conquests, and here, as before, we may accept the number as a vague and general estimate.

According to the familiar story, a heroic effort was made on the part of the Greeks to preserve their beloved library, and the Arab conqueror was disposed to yield to their request. He dared not do so, however, without first sending word to Omar, the Khedive, at Medina. Omar's reply has passed into a proverb: "If the books of the library," he said, "are the same as the Koran, they are useless; if not the same, they are worse than useless. In either case let them be destroyed."

ΕΥΑΓΓΕΛΙΟΝ ΚΑΤΑ ΛΟΥΚΑΝ

ΑΓΙΟΥ ΕΥΑΓΓΕΛΙΟΥ



ΠΕΡΙ ΤΗΣ ΠΙΣΤΕΩΣ ΚΑΙ ΤΗΣ

ΑΓΑΠΗΣ ΚΑΙ ΤΗΣ ΕΛΠΙΔΟΣ

ΤΩΝ ΠΙΣΤΕΥΟΝΤΩΝ

ΜΕΤΑ ΤΗΝ ΕΞΟΥΣΙΑΝ

ΚΑΙ ΤΗΝ ΔΟΞΑΝ ΤΟΥ

ΘΕΟΥ ΠΑΤΕΡΟΣ

ΤΟΥ ΚΥΡΙΟΥ

ΙΗΣΟΥ ΧΡΙΣΤΟΥ

ΤΟΥ ΥΙΟΥ ΤΟΥ

ΘΕΟΥ

ΤΟΥ ΚΥΡΙΟΥ

ΙΗΣΟΥ ΧΡΙΣΤΟΥ

ΤΟΥ ΥΙΟΥ ΤΟΥ

ΘΕΟΥ

ΤΟΥ ΚΥΡΙΟΥ

ΙΗΣΟΥ ΧΡΙΣΤΟΥ

ΤΟΥ ΥΙΟΥ ΤΟΥ

ΘΕΟΥ

ΤΟΥ ΚΥΡΙΟΥ

ΙΗΣΟΥ ΧΡΙΣΤΟΥ

ΤΟΥ ΥΙΟΥ ΤΟΥ

ΘΕΟΥ

There was no court of appeal from this decision, and so the treasured books of Alexandria were sent to make fires in the various baths of the city, and it is alleged that for six months no other fuel was required. Thus was dissipated finally the most extraordinary collection of books of antiquity.

It must be added that there are grave historical doubts as to this alleged final destruction of the Alexandrian Library by the Arabs. It appears that the story rests on the very insecure foundation of a narrative by Abulpharadje, written in the thirteenth century. The story has taken its place among the disputed events of history, but the probability seems to be that there was no Alexandrian Library in existence at the time of the Arab conquest, the last great collection of books there having been destroyed by Theophilus.

In this view, it was not Mohammedan, but Christian zeal and bigotry that deprived posterity of the treasures of ancient learning.

When one speaks of books, one thinks naturally enough of the familiar bound volumes of today, but it hardly needs saying that there were no books having the appearance of these in the ancient collection of Alexandria. The books there were in the main written on sheets of papyrus, not folded, but made into rolls.

Doubtless a great many of the books, particularly those from Pergamus, were written, not on papyrus, but on parchment. From the earliest day the skins of animals had been used at least occasionally for purposes of book-making, as is shown by the familiar passage in which Herodotus states that the Ionian Greeks were one time forced to use this material when the supply of papyrus from Egypt failed them. But it was a classical tradition that true parchment was the invention of King

Eumenes of Pergamus, the name "parchment" itself, indeed, being derived from Pergamus, the name of the city where it was alleged the substance was first employed.

It was said that Eumenes had been forced to make this substitution because the kings of Egypt, jealous of the growing influence of the Seleucian capital, had refused to export papyrus, hoping thereby to shut out the threatened rivalry of the library of Eumenes.

Whatever the truth of this story, it is clear that parchment was invented some centuries before the Christian era, and we have no reason to doubt that it was used to a considerable extent throughout the Ptolemaic period. It may be questioned, however, whether it gained any special vogue in Egypt, where the abundance and cheapness of papyrus would naturally stand in the way of its introduction. One may suppose, arguing merely from the uniformity of human traits in all generations, that editions de luxe of certain books may have been issued in which parchment took the place of papyrus. But if such was the case, either the scarcity of these, or their more perishable nature, has prevented any examples from coming down to us. In any event, then, papyrus was the usual book-making material of Ptolemaic Egypt, as it had been indeed of the Egypt of the old régime for some thousands of years.

Papyrus occupied then exactly the position that paper occupies in the Western world today, and it is quite fitting that the word "paper" should have been derived from the word "papyrus."

The art of manufacturing papyrus was a relatively simple one, requiring more of patience than of special skill or ingenuity. Stems of the papyrus plant, or the pieces of bark stripped from these stems, were laid to-

gether to form two sheets, the fibers of one lying at right angles to those of the other. Some glutinous medium was then applied, and the whole being dried under pressure became a sheet of papyrus. These sheets were usually from six to twelve inches wide, and they were neatly fastened together in the manufacture to form strips long enough often to receive the entire text of a book, so that such a work as, for example, the *Iliad*, when placed on the market or upon the shelves of the library, might occupy but a single roll.

In addition to papyrus, a common medium for the reception of writing was a thin slab of wood. From an early day such slabs of wood, carved usually to a lower level in the center and curiously resembling a child's slate of today, were used as writing tablets very generally both in Greece and Rome, the writing surface being usually covered with wax. Such tablets, often bound together in several sheets, were used for various business purposes until a late period of Roman history. But it was also customary in Egypt to write on bits of wood with ink.

It may be doubted whether books in the proper sense of the word were ever written on this material, but business documents are still extant to testify to the prevalence of this custom.

In the most ancient Greek manuscripts two very different types of writing are presented. The language throughout is Greek, and the characters are fundamentally the same, but the documents of one type have the appearance of being produced hurriedly, as if the scribe were impatient of the time consumed and were anxious to make an end of his task. All such are business documents

The writing on the other type of documents is much

more even and methodical. Here, apparently, the scribe has aimed at neatness and clearness, and this is precisely what one might expect when one considers that these are no longer the hurried transcripts of business dealings, money bills, tax receipts, and the like, but are the text of books—the permanent literature of the time—written no doubt for sale in the market; that is to say, serving precisely the purpose of the modern printed book.

It is obvious that much the same difference in kind, if a less difference in degree, existed between the cursive hand of every-day life and the book-hand of these ancient manuscripts, that is seen today between the script of ordinary correspondence and the type of the ordinary book. Throughout the course of the development of writing in succeeding ages this difference is always and everywhere to be noted. Book-making is always a relatively leisurely task in which accuracy and clearness are aimed at, whereas the business scribe is always tending to adopt short cuts and to develop a cursive script.

One other word should be said about the characters in which these earliest Greek manuscripts are written. The close similarity of many of the letters to the letters of the yet more ancient Greek inscriptions, and, indeed, to the original Phenician itself, is apparent, but a no less apparent similarity is shown to the capital letters which we still employ to this day.

This conservatism of the book-hand of Europe is remarkable. No other writing has preserved with anything like a corresponding accuracy the forms of so many of the letters of the earliest Semitic alphabet. But, on the other hand, it will be obvious—to any one having the slightest acquaintance with Greek texts as commonly

3 babillona	2 conciliu	2 corticu
2 babillonu	2 cinamū	2 corticum
4 polomū	1 admomū	W mulst
1/2 mulaccū	2 cinamomū	m muscum
1 siricu	13 molobracū	Y persif
1 pseudosiricu	13 molobracinū	Y persica
2 holosiricu	2 olagonū	Y persicum
1 pederus	2 olau	Y uiscū
2 pederastina	2 olia	Y inuisca
7 taria	2 oleuotū	2 mirra
2 tiranū	2 oleasru	2 glauca
1 xerapinū	4 nardifoliū	2 sulphur
1 xerapimū	1 baromata	1 billanum
2 cocca	2 croci	2 gallenum
2 coccinū	2 crocū	2 sigmentū
2 coccentū	3 balsamū	2 sigmentarius
1 amiteccū	2 obsamū	1 cultus
1 amiteccanū	2 antidotū	1 in
1 iatinū	2 acopū	1 cultor
1 iatineū	2 miracopū	1 cultura
2 sororeclatu	2 lupicu	1 cultrum
1 prixe	2 colofoniū	1 culcellu
1 prixenū	2 miniastra	1 culmen
2 CON	2 miniolū	2 calamita
Ch C A	2 coraxe	2 manile
		2 cramen

DIGNUM JONAS DIVITIUM ESPIOLA PONIT
 TURPITER HEUDOXI GLANGIUMBY OBLUPETACI
 UCURRU UARIA GEMINARUM LUCE INIGANTEM
 MURANT DUMBITEOLIS CREPITANTIA LOA
 OSOLDO EXATRO PRECIOSI PONDERIS AXEM
 EFYAT INHIANE OBTUMBY & RADIOSUM CUI
 A PUNTO ALBENTE SERIOM QUASUMMA ROTURUM
 FLIZUR OLECCI PALLENTI CONTINET OLBE ASE



EULCUNOTA ACIES INDEOTIONIS LAOPES
 SPONCE SUA UORTIS TENEBAT PHIDA LIGIU
 LUXURIS SERVITE UOLENTI DOMINUS FLUENTI
 L'UMI PARI & LAXA SANCTARUM LOCS TENORI



FACSIMILE OF MS OF AURELIUS PRUDENTIUS,
 CHIEF CHRISTIAN POET OF THE EARLY CHURCH

printed today—that such texts differ very widely from the ancient ones. This modern Greek script was developed about a thousand years after the Ptolemaic epoch, and the ancient Greek writer would be quite unable to read his own productions could he see them in their modern garb. But this script of the ancient Greek probably differs but little from the characters in which the works of classical Greece were first inscribed. The steps of development by which this ancient script became modified may be followed in extant manuscripts.

There is one feature of the ancient writing which these manuscripts, in common with most of the monumental inscriptions, present that is sure to strike the modern reader as extraordinary, whether or not he understands the language in which the inscriptions are written. It will be seen that the letters follow one another right through each line without any obvious breaks to indicate the words, and without any attempt at punctuation. It is a curious and highly interesting fact that the most archaic of alphabetical inscriptions—that of the Moabite Stone—shows the words divided or separated from one another by dots. The ancient Persians adopted a similar expedient, marking their words with straight lines. There are a few of the most ancient Greek manuscripts in existence which also illustrate the same custom, their words being separated by marks similar to our colon.

These examples show that the idea of facilitating the reading of texts by separating the words had presented itself at the very earliest stages of alphabetical writing.

But for one reason or another this seemingly very plausible custom had been abandoned long before the Christian era, and a thousand years or so elapsed before the good old custom was revived. It would seem almost

as if the scribes of antiquity and of the Middle Ages went out of their way to make reading difficult. Unless it were the desire to do so partly with the idea of keeping all rudiments of education from the masses, one can hardly understand why so useful a custom as that of marking the divisions between words should have gone out of use.



ANTIQUE SCULPTURE FROM SICILY

bono ut faciatis uoluntate d. fa-
ciens in uob quod placet copi-
pium xpi. cui e gta in secula
seculorum amen.

Rogo aut nos fratres uesuf
feratis uerbum solaci et
enim per paucos scripsi uobis,
Cognoscite fratrem nrm timo-
themum dimissum cum quo si
celerius uenerit uidebo uos.
Salutate omnes ppositos uos
& omnes scos. Salutate uos uera-
lia. Gratia cu omib uob amen.
Explicit epla ad hebreos in octo
lib. v. dcc. Amen
In hincione indiuidue trinitatis
quapianus scatis scripsit be-
libini suis fratribz peregrinis
dia obsequiescat in pace
p pabre penere diuine amen.

An. et uim hodie feria vi. an. dñi m. lxxviii.

XIII

LIBRARIES AND BOOK-MAKING IN ANCIENT ROME

NOTWITHSTANDING the entire loss of all the books produced in Rome in the early days, we are supplied with tolerably full information as to the making and use of books there during the later period of the Republic, and throughout the Empire.

The private library discovered at Herculaneum gives a perfectly clear idea of the way in which the books were kept in an ordinary house. This library contained 1,700 books. It was so small a room, however, that all its shelves could be reached from its center. The books themselves, consisting of rolls, were contained in round cases called *capsæ*, and we have the further evidence of various statues and pictures, as well as written descriptions, to prove that this was the usual method of caring for manuscripts.

The books of this period were always in rolls, never folded after the modern method. This applies not merely to papyrus books, but to the parchment ones also. Generally the strip of papyrus or parchment was inserted at one end into a slit in a reed or cane about which the manuscript was rolled as written. Usually a corresponding cane was supplied at the other end after the book was completed, so that the book could be rolled either way, thus greatly facilitating the reading.

Presumably the book as ordinarily kept ready for use would be rolled on the lower reed, so that any one

unrolling it began at once with the first column, the columns being arranged transversely.

A tag or label was usually attached to the manuscript, and these tags are represented in the paintings on the walls of Pompeii as projecting from the cases in which the books are stored. The length of a papyrus or parchment strip varied indefinitely, but it appears to have been usual to write an entire book of any given work on a single strip. The relatively short books into which most classical works were divided facilitated this method; or, perhaps, it became customary to divide works into small books for the convenience of the scribe, rather than because of any logicity in the method itself.

It appears that in the later Roman times it was quite the fashion to have a library in every ordinary house, and some of these libraries attained very respectable proportions. Thus it is said that the grammarian Epaphroditus had a library of 30,000 volumes, and that Sammanicus Serenus had one of 62,000 volumes.

The fact that Augustus confiscated 2,000 copies of the pseudo-sibylline oracles testifies to the wide prevalence of the reading, or at least the book-buying habit. No doubt this distinction between the buying and the reading of books should be clearly drawn in the case of the Romans, as elsewhere. Still, it will not do to draw too sweeping conclusions from the sneers of Seneca and Cicero, which are so often quoted as implying that the Romans bought books as ornaments rather than for their contents. Doubtless the reproach was true then as now of a large number of purchasers; still, the making and the selling of books must always imply the existence of a taste for books, and such a fashion could never have come into vogue unless a very large number of people were actually book readers.

It is matter of record that the book business in Rome assumed very notable proportions. Book stores were numerous in the more frequented parts of the city, and it would appear that the trade flourished quite in the modern fashion. Within the shop the rolls were ranged on shelves for the inspection of the would-be purchaser, and outside on pillars were advertised the names of the authors represented.

Naturally enough, when private libraries were the fashion, there were numerous public libraries as well. According to Publius Victor, there were no fewer than twenty-nine of these public libraries in Rome. Asinius Pollio, the friend of Cæsar and the famous patron of literature of his time, who died in the year 6 B.C., was credited with being the founder of the first public library, altho there is a tradition that Ornelius Paullus, the conqueror of Macedonia, brought back with him to Rome a large collection of books in 168 B.C. Be that as it may, there probably was no very great taste for reading in Rome at that early period, and it was not until the time of Augustus that public libraries began to assume real importance.

Augustus himself, carrying out the intention of Julius Cæsar, founded two public libraries, one called the Octavian and the other the Palatine. From that time the founding of public libraries became a fashion with the Emperors. Tiberius, Vespasian, Domitian, and Trajan successively added to the number, the most famous collection of all being the Ulpian Library of Trajan. No available data have come down to us as to the exact size of these libraries, but the respectable proportions of some of the private collections make it a safe inference that some, at least, of these public libraries probably contained hundreds of thousands of books, since

we can hardly suppose that a private library would be allowed to outrival the imperial collections.

When one reflects on this prevalence of books, the very natural query arises as to how they were produced, and the answer throws a vivid light on social conditions in Rome. The enormous output of books, almost rivaling the productions of the modern press, was possible solely because of the great number of slaves in Rome.

Book-making was a profession, but it was a profession apparently followed almost exclusively by slaves known as *librarii*.

These educated slaves were usually Greeks. A large publishing house, of which there were several in Rome, would keep a great number of them both to make the materials for books and to transcribe the books themselves.

It is known that shorthand was practised extensively in Rome, and it has been supposed that a large number of the current books were written in this abbreviated hand. This supposition, however, appears more than doubtful, for it is hardly to be supposed that the general public took the trouble to learn the Tironian system, by which name the shorthand script was known; Tiro, the secretary of Cicero, being commonly, tho no doubt incorrectly, credited with its invention.

As to the latter point, there are various references in the Greek classical authors to the practise of shorthand in ancient times. It is said even that Xenophon took down the lectures of Socrates in this way, and whether or not that statement is true, the existence of the rumor is in itself evidence of the prevalence of the custom from an early day.

Quite probably Tiro developed a modified and greatly improved system of shorthand writing, and doubtless



- IMPIETATES
 HIEREMIA
 SED QUONIAM IR
 TRASTITSONTRA
 ETNESTISADUER
 SARIS EXACERBAS
 TISENADUEUMQ
 ETOSFECTIONE
 AETERNUMSACRI
 FICANTESDAEMO
 NIISEINO NDO
 NEMAPOSTOLUS
 ADROMANOS
 DICENTES ENIM
 SE ESSE SAPIEN
 TES ET UT FACTI
 SUNT ET INIMIC
 RUNT GLORIAE
 IN CORRUPTIBILIS
 OMNISIMILITUDI
 NEMATINISCOR
 RUPTIBILISHOMI
 NISEIUSLUCRU
 ETQUADRAPEDV
 EISERPENTIVM
 PROPTERQUOD
 TRADIDITILLOS
 IN DESIDERATOR

DISILLORUMIN
 INQUINDIHACIT
 CONTRIDELUSAP
 FICIANTECORPORA
 SCITAINSEMENTP
 SISQUITRANSMU
 TAUERUNTIERI
 TATEMINDENONDA
 EIOEJCOLIERUNT
 EISERUIERUNT
 CREATURAE POT
 USQUAMCREATIO
 RIQNESTBENE
 DICTUSINSaecula
 PROPTERQUOD
 TRADIDITILLOS
 INREPROBUMSC
 SCITU FACIANT
 QUAE NON CONVIC
 TIUNT
 NONSUTERANDMAU
 ANMAUDETROGTA
 MATAKMALESIA
 AETIOEADUQUIMOS
 ITSIUDICIUMPO
 PULUSMEUIN
 EGORUMCORDE
 LEXMEAESINOIT

[illegible]

this became popular, since lexicons were written interpreting the Tironian script in terms of ordinary Latin. But, as has been said, all this does not make it probable that the average reader understood the script, and it seems much more likely that the popular authors were represented in the ordinary script, subject, however, to numerous abbreviations.

The writers who were most in vogue in imperial Rome are said to have been Ovid, Propertius, and Martial among the satirists; Homer, Virgil, and Horace among the poets; and Cicero, Livy, and Pliny among prose writers. It is alleged that the works of most of these were in every private collection.

Of all this great store of literary treasures not a single line has been preserved in the original manuscript, save only a few rolls from the library at Herculaneum, and most of these are charred and damaged beyond recognition.

Thanks to the use of slave labor, it would appear that the Roman publisher was able, not merely to put out large editions of books, but to sell these at a very reasonable price. According to a statement of Martial himself, a very good copy of the first book of his epigrams could be purchased for five denarii. This presumably must refer to the cheapest edition, probably a papyrus roll, tho no definite data as to the relative cost of papyrus and parchment are available.

Naturally, there were more expensive editions put out for those who could afford them. It was customary, for example, to tint the back of the parchment roll with purple; at a later day the inscribed part itself was sometimes tinted with the same color, and this custom also may have prevailed as early as the Roman time.

Certain books were illustrated with pictures, as ap-

pears from a remark of Pliny; but this practise was undoubtedly very exceptional. It may not have been unusual, however, to ornament or emphasize portions of the manuscript by using red ink, for the ink wells illustrated in the paintings of Pompeii are often shown to be double, and the presumable object of this was to facilitate the use of ink of two colors.

The pen employed by the Roman scribe was made of a reed and known as a calamus. It was sharpened and split, not unlike a modern quill pen. The question has been raised many times as to whether the Romans did not employ the quill pen itself. Certain pictures seem to suggest that the quill pen was used not merely by the Romans, but by the Egyptians as well. The evidence is by no means decisive, however, and the first specific reference to a quill pen was in the writings of Isidore, who died in 636 A.D. This proves that the use of quills had begun not later than the seventh century, but it is extremely doubtful whether the Romans employed them.

The quill seems so obvious a substitute for the reed that its non-employment causes wonder. But the history of all simple inventions shows how fallacious would be any argument drawn from this obvious inference. Incidentally it may be noted that the reed pen held its own against the quill for some centuries after the invention of the latter. Even in the late Middle Ages the reed was still employed for particular kinds of writing in preference to the quill, and no doubt a certain number of people for generations continued to prefer the reed, just as there are people now who prefer a quill pen to the steel pens that were perfected in 1830.

Every desk in the reading room at the British Museum, when I last visited it, was supplied with a quill

repleamur & secundum semper inuicem

auxilium per dominum nostrum Iesum Christum in omni

IN OMNI ORATIONE

OMNI ANIMAE NOSTRE DOMINI

Ex iate domine per caritatem tuam in
quam equod deditur tunc promissum
usque in finem seculi deditur operari
Conscientias nostras quod omnipotens deus coadi
die visitando purificet ut ueni
ens filius tuus dominus noster per caritatem sibi
in nobis inueniat mentionem per ^{super} **S**uper

Accipiamus tibi domine celebrandum pla
catum gratiae quod caritas caritas ne
conditionis emendat caritas nominis
reddat acceptos per dominum nostrum

Quoniam ^{per nos} atque quoniam inueniamus in
mens per uoluntatem dispensant in
eae corporis clementis plurimorum
fontis incrementa per seculum donec




rumus et quamvis anima
libus dedit septem angelis
septem phylas animas plenas
maandit de iumentis in ista
molemm. Et implum est con-
plum fumo et mandit de et de
iumentis eius. Et nemo potest in-
ire in templum donec consumma-
etur septem plagis septem ange-
lorum. Et audiu uocem magna
ex celo dicentem. Ne cretum duc
septem phylas ut de in terram.

Et audiu uocem magna
ex celo dicentem. Ne cretum duc
septem phylas ut de in terram.

Et implum est conplum fumo
et mandit de et de iumentis eius.

Et audiu uocem magna
ex celo dicentem. Ne cretum duc
septem phylas ut de in terram.


 ለሐብክ፡ገላጥ፡ሃ፡ው፡
 ጽሐፈ፡ኸንዘ፡ሀሐ፡
 ብሔረ፡ሮማ፡አዋ፡
 ላከ፡ሐዋርያሁ፡ዘ
 ጥላካ፡በእንጥ፡ከብ
 ኦ፡ወኦ፡ኮኒ፡አዋ፡ከ
 ብእ፡ዘእንባለ፡በእ
 ንጥ፡ኦግዛእኦ፡አያ
 ሮሳካከርከቶከ፡ወ
 ኦግዛ፡አብሔር፡ኦ
 ብ፡ዘእንገሠ፡ኦ፡ከ
 ሞወታን፡ወከኦ
 ሙ፡ኦ፡ፊደኒ፡ኦሌ
 ሞከሌያ፡ለቤተከ
 ሮከ፡ፊደን፡ዘገላጥ፡
 ከላዋ፡ለከሙ፡ወጸ
 በላዊተ፡ለሮያ፡ወበላዊ

2፡ኦግዛእኦ፡አብ
 ኦ፡ወኦግዛእኦ፡አብ
 ኦ፡ከርከቶከ፡ዘመ
 ጠወ፡ሮኦከ፡በእንጥ፡
 ኦ፡ጠሐተን፡ከመያ፡
 ላካ፡አዋ፡ዘ፡ሃሐ፡
 ዘሮተታወ፡ጽሐፈ
 ኦ፡ጸ፡በፊታ፡ኦ፡ኦግ
 ዘኦብሔር፡አብኦ፡
 ዘሮተ፡ከብሔር፡ለ
 ሃለሙ፡ሃላዎ፡አዋ
 ኦ፡ኦ፡ኦ፡ኦ፡ኦ፡ኦ፡
 ሙ፡ከሙ፡ዘ፡ፍ፡ጠ፡
 ሃሌ፡ለከከሙ፡አዋ
 ዘ፡ጸወ፡ወከሙ፡ጸ፡
 ገሁ፡ለከርከቶከ፡
 ከተ፡ከልኦ፡ተ፡ጸ፡
 ሮተ፡ወኦ፡ለሮ፡ለኦ፡
 ዘእንባለ፡ዘየሀ
 ጸ፡ኦ፡ኦ፡

as well as a steel pen; and a fair proportion of the readers there seemed to prefer the former.

It would not do to leave the subject of Roman books without at least incidental mention of the tablets which were in universal use. These were probably not employed in writing books for the market, but it is quite probable that many authors used them in making the first drafts of their books. The so-called wax tablet was really made of wood, quite in the form of a modern child's slate, the wax to receive the writing being put upon the portion that corresponds to the slate proper. These tablets were usually bound together by twos or threes, and only the inner surfaces were employed to receive the writing, the outer surface being reserved for a title in the case of business documents, or for the address when the tablet was used as a letter.

When used as business records or in correspondence, the tablets were bound together with a cord, upon which a seal was placed.

It was quite the rule for a Roman citizen to carry a tablet about with him for the purpose of making notes. The implement used in writing was a pointed metal needle known as the stylus. It was almost dagger-like in proportions, and was sometimes used as a weapon. It was said that Cæsar once transfixing the arm of Cassius with his stylus in a fit of anger in the senate chamber itself. The other end of the stylus was curved or flattened, and was used to erase the writing on the tablet for corrections or to prepare the surface for a new inscription.

The subjects treated in the various documents other than books proper are full of suggestion. There are letters, farming accounts, epitaphs, deeds, taxation returns, and the record of the sale of a slave.

A flood of light is thrown on the history of the period by these business documents. They tell of the every-day life of the people in Egypt under the domination of Rome, and they have an added importance because no similar documents have been preserved from the seat of the empire itself.

In addition to papyrus there was another form of material commonly used to receive casual writing; namely, the so-called ostrakon. This was not necessarily an oyster-shell, but was usually a tablet of earthenware. Its use in Greece is familiar through the well-known fact of its employment as a ballot in voting for the ostracism of any obnoxious citizen. In Egypt of the Greco-Roman period it appears from the specimens preserved that ostraka were used to take the place of papyrus in certain business documents such as tax receipts. The durability of the material no doubt gave it additional value for such purposes



THE DYING GLADIATOR (OR GAUL)